Vol. 29 FEBRUARY, 1943 No. 2

American Journal of Orthodontics and Oral Surgery

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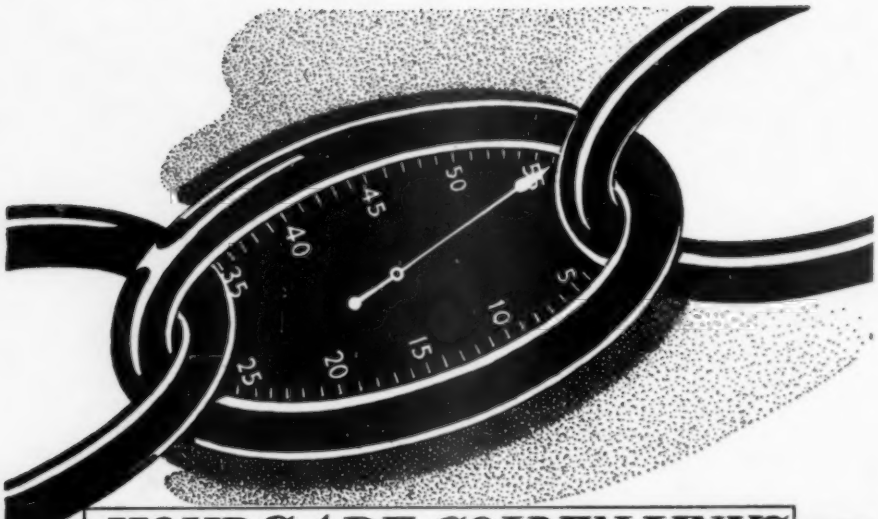
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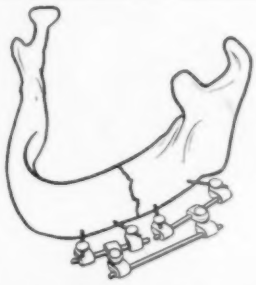
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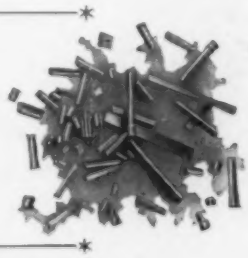
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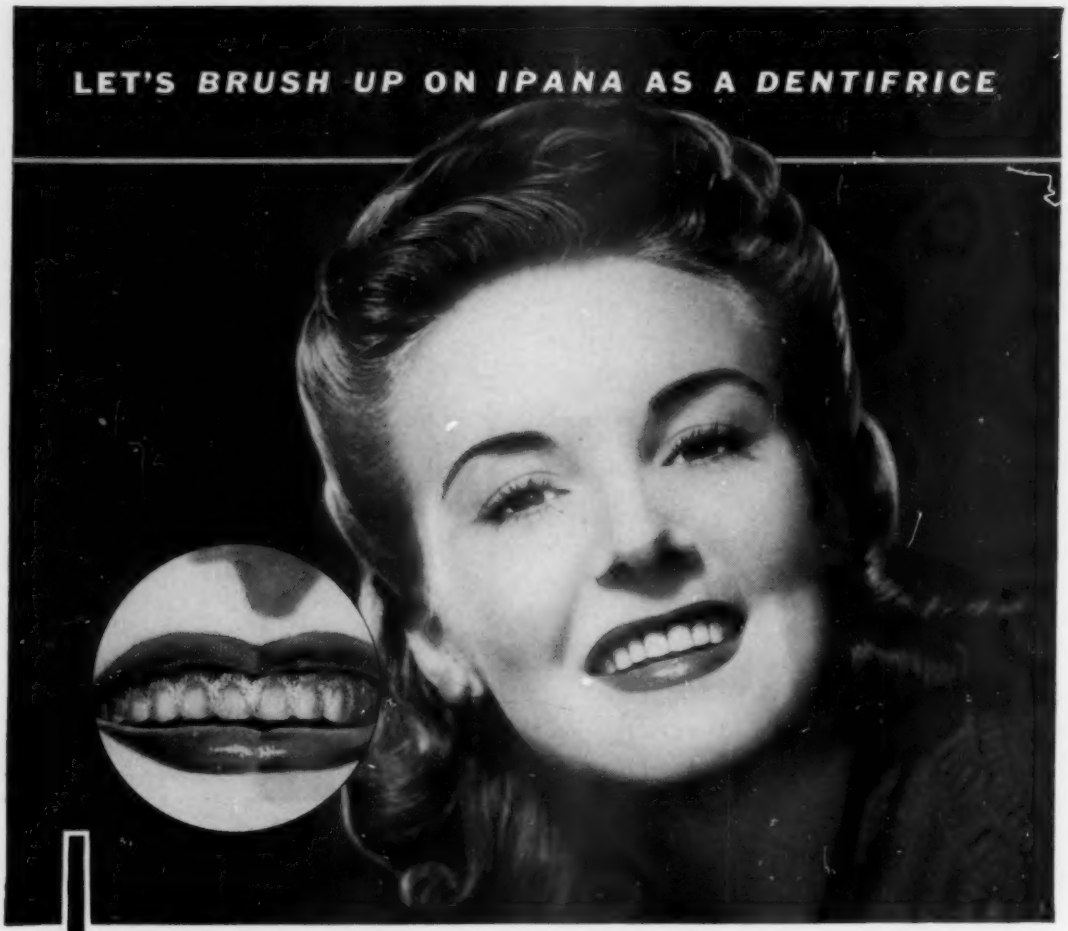


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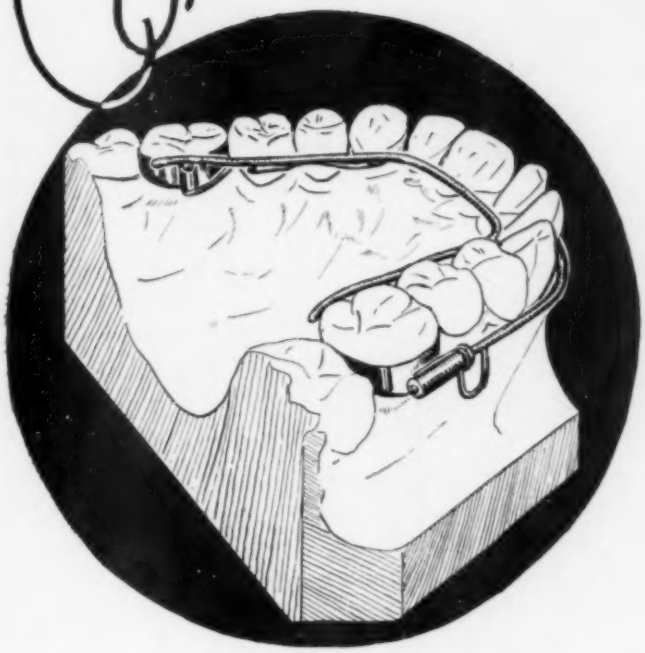
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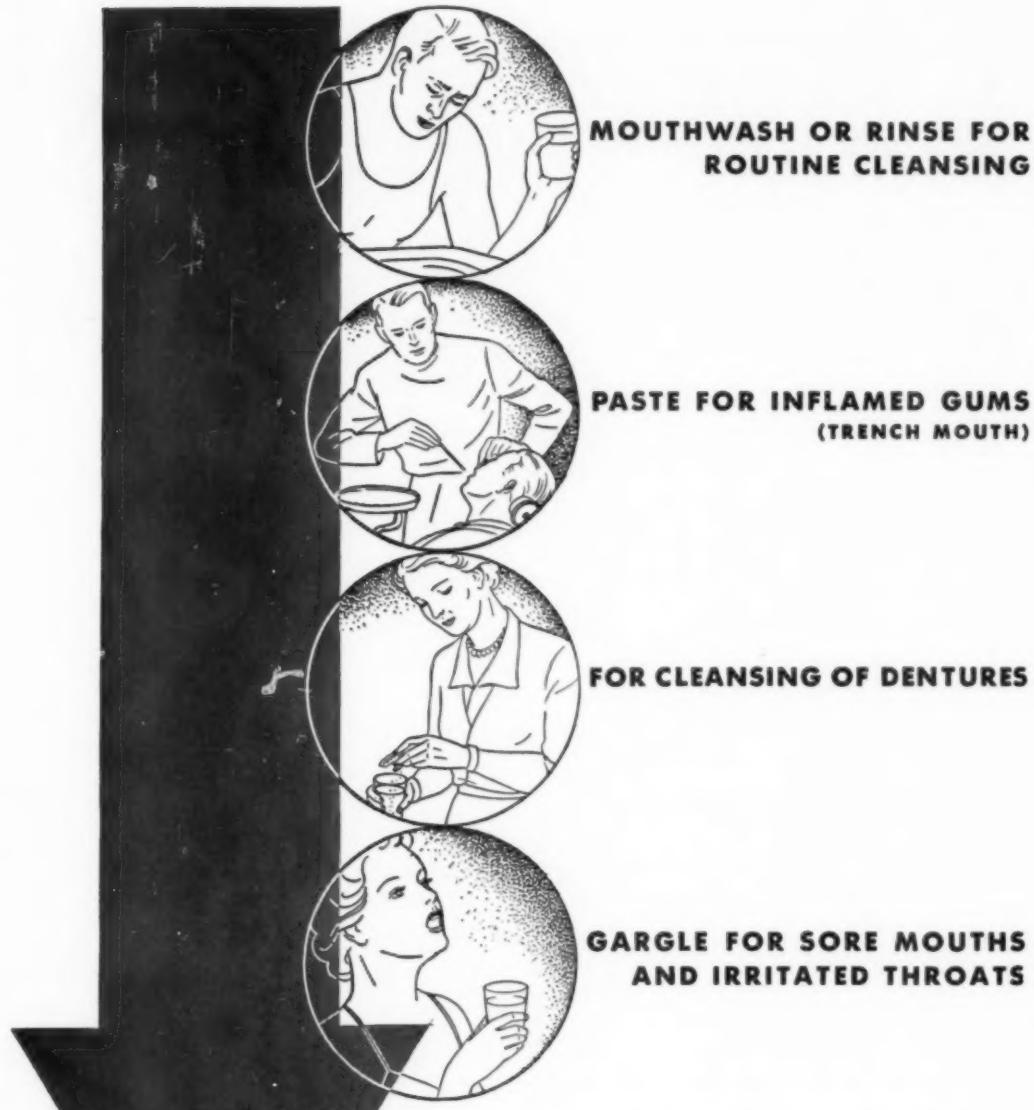
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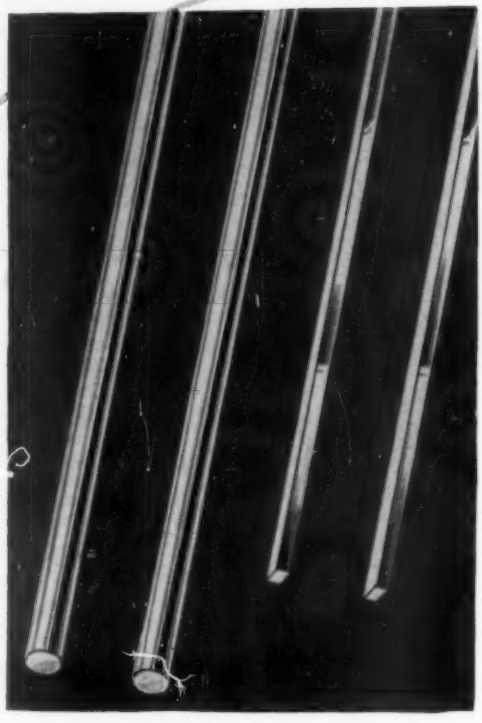
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Office of the Editor: 8022 Forsythe Boulevard, St. Louis
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American
Journal of Orthodontics
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VOL. 29 FEBRUARY, 1943 NO. 2

Original Articles

DENTAL CONDITIONS IN CLEIDOCRANIAL DYSOSTOSIS

GORDON R. WINTER, D.D.S., BINGHAMTON, N. Y.

DURING recent years, much has been written concerning the oral manifestations of general diseases and developmental phenomena, but there is little record of the oral aspect of cleidocranial dysostosis in the standard works on dentistry. An extensive search of the dental periodical literature reveals few reports of this condition. Although it is a relatively rare syndrome, it seems fitting to record the salient facts concerning this unique and bizarre dysplasia, and to attempt to clarify what understanding we may have of the dental and oral abnormalities.

Cleidocranial dysostosis, occasionally referred to as Marie and Sainton's disease, is a condition in which the patients have defective clavicles and skull deformities, with or without other multiple abnormalities of the osseous and dental tissues. This condition occurs spontaneously or is inherited.

Meckel, in 1760, reported an infant born without clavicles. Martin, in 1765, reported a father and son with incomplete clavicles, and Morand, in 1766, an infant with the clavicles missing. These authors seem to be the first to record any of the cardinal symptoms of this condition. Pierre Marie and Paul Sainton, in 1897, were the first to recognize four important symptoms and to name this clinical entity an independent disease, "cleidocranienne dysostose hereditaire." They characterized the condition by (1) aplasia, more or less marked of one or both clavicles, (2) exaggerated development of the transverse diameter of the cranium, (3) delay in ossification of the fontanels, and (4) hereditary transmission. The clavicular deformity is the most essential feature.

The following abnormalities have been reported radiographically and clinically:

In general appearance, these patients are extremely short in stature. Mentally they are normal or above the average.

Skull and Head.—The skull is usually brachycephalic with an increase in girth and breadth. It is frequently square with the occiput and vertex flat. Only one case of dolichocephalus has been reported. The cephalic index (the maximum breadth times one hundred divided by the maximum length) is generally above eighty in these cases. Radiographs frequently show unossified areas, patency of fontanels, open sutures, and multiple Wormian bones. The presence of metopic sutures has been reported. The fontanels may close much later than normally or remain open as diastemas throughout life. Ossification of the fontanels, when complete, often leaves a marked depression or furrow. Defects may occur at the bregma or asterion. The frontal, parietal, and occipital bosses are unduly prominent, with the frontal eminences being largest and occurring most frequently; involvement of the other eminences occurs in the order in which they are listed. The face is small in comparison to the rest of the head, because of deficiency in the bimaxillary dimension of the face. The bones of the base of the skull are also small. The accessory sinuses are often underdeveloped or absent, the nasal and lacrimal bones may be found to be defective or missing, and the zygoma may be poorly developed. Undersized mastoid processes are recorded, and occasionally, abnormalities of the sella turcica are noted. The nose may be broad at the root, with the bridge depressed. The size, roof, and ridges of the orbits may be abnormal, frequently giving a mild exophthalmic appearance. A few cases of ocular hypertelorism are recorded.

Teeth and Jaws.—The maxilla is commonly recorded as micrognathous. A narrow, high, arched palate with a median furrow is frequently reported. A similar condition may be reproduced in children who suffer from nasopharyngeal obstruction, where the disuse of the nasal air passages entails lack of development of the maxilla, narrowing of the palate, and overcrowding of the teeth. A complete cleft of the bony tissue of the palate with the soft parts intact has been reported six times; complete cleft of the hard and soft tissues, three times. The alveolar process of both jaws has been reported lacking in one case.

The mandible is generally prognathous and slightly undersized. Nonunion at the symphysis of the mandible has been reported.

Cleidocranial dysostosis is also characterized by the most extreme form of delayed eruption of the teeth. This startling condition frequently causes the eruption of the permanent teeth to be almost completely inhibited throughout life. The early reports often mention some of the oral manifestations, but it is only since the making of full-mouth radiodontic examinations that the large number of unerupted teeth has been definitely connected with this syndrome. Almost every striking case which has been thoroughly radiographed has shown unerupted or ectopic teeth coexisting with the other features.

The deciduous teeth are slow in erupting and extremely slow in being exfoliated. In many instances they are not lost until maturity. They are usually in normal position and free from defects such as hypoplasia.

Many of the permanent teeth are impeded in their eruptive movement but are formed unerupted in the jaws. Those which do not have predecessors, such as the first and second molars, are more likely to erupt normally. The

third molars are entirely missing in many cases. Enamel defects, distorted and curved roots are common. Many unerupted supernumerary teeth have been recorded especially in the lower bicuspid region. Congenital partial anodontia of varying degree is frequently noted. Permanent teeth often appear through the mucous membrane of the mouth late in life, but this is usually the result of resorption of the overlying tissues following the wearing of artificial dentures. Patients showing this marked disturbance in the development of the teeth have been known to have had follicular or dentigerous cysts. The prognathism of the mandible, retention of the deciduous teeth, and the suppression of the permanent teeth cause a marked disarrangement in the occlusion. This condition accentuates the liability to caries, periodontoclasia, and hypertrophied gums, all of which have been frequently reported.

Shoulder Girdle.—A variety of changes in the clavicles may occur from a thinning of the acromial end, or dissolution of the continuity, to complete absence of both clavicles. Defects of the acromial ends are more common. One case shows a sesamoid bone between the sternal and acromial fragments. In cases where both portions are definitely separated, the opposing ends are rounded and sometimes overlap, the gap being filled by a fibrous band. This condition may be bilateral or unilateral. It has been erroneously diagnosed as ununited fracture. Complete absence of both clavicles is rare, since a rudimentary sternal stub usually can be found. Most persons who have this dystrophy are not aware of it and, unless carefully examined, would be classed as normal. There is usually no impairment of the physical processes, and the great majority are able to do strenuous work. A few complain of weakness and tire easily. Only one case is reported where the outer fragment of the clavicle exerted pressure on the brachial plexus which was relieved by the removal of the fragment.

The defects of the clavicles give unusual mobility to the shoulders. Frequently they can be brought forward so that the deltoid eminences touch in the midline. This preternatural mobility usually causes no pain or discomfort. Some patients consider themselves double-jointed. In the resting position the shoulders are lowered, swung forward, and the scapulae appear similar to what is seen in typical clavicular fracture. The scapulae frequently demonstrate underdevelopment, such as the absence of the supraspinous fossae. They are commonly winged.

Many variations in the size, origin, and insertion of the sternocleidomastoid, subclavian, pectoralis major, deltoid and trapezius muscles are found. In these cases, when the clavicles are partly or entirely missing, the muscles are attached to the cord of connective tissue that replaces the osseous tissue. These muscles are sometimes feebly developed. In spite of the frequent involvement of the sternocleidomastoid muscles (in some cases being entirely absent) no case of torticollis has been reported.

Abnormalities of the vertebrae may cause gross visible deformities such as scoliosis, kyphosis, and lordosis of the vertebral column. Prominent transverse processes of the seventh cervical vertebrae, synostosis of cervical vertebrae, separation of sacral vertebrae, spina bifida, and syringomyelia are recorded. Cervical ribs are common. The chest is often found to be funnel shaped. Sometimes the sternum is depressed and the xiphoid process missing.

Pelvis.—Since there have been relatively few cases of cleidocranial dysostosis where the pelvis has been reported, and these, before the more modern methods of pelvimetry devised by Caldwell and Moloy, and Thoms, it is difficult to describe the typical pelvis. However, tabulation of individual observations would indicate that in the main the pelvis is "generally contracted" or the "android type" of Caldwell and Moloy. In most cases the forepelvis in contracted and the inlet heartshaped. The early writers mention little about the amplitude of the outlet except to agree that the subpubic angle is acute or narrowed.

The general appearance of the pelvis suggests a contracted rachitic deformity with which it is often confused. The distinguishing feature is lack of normal ossification in the region of the (1) pubic symphysis, (2) sacroiliac articulations, and (3) crest of the ilia.

Extremities.—The arms are least affected, although partial or complete absence of the radius and ulna has been reported. The distal, middle, and proximal phalanges, as well as the metacarpal bones, occasionally show various changes in ossification, density, and expansion. Syndactylism and a double metacarpal bone have been recorded.

In the thighs and legs, tibial curvatures, deformities of the fibulae, and faulty ossification of the necks of the femora resulting in knock-knees, bowlegs, and other abnormalities are noted. The changes that have been noted in the metatarsus and the phalanges of the feet are similar to those recorded for the bones of the hands but occur with greater frequency. A supernumerary toe and club feet have been found. The development of the astragalus and calcaneus has been found to be poor. Epiphyseal lines in the long bones may be observed in maturity.

Limping, waddling, or other peculiarities of the gait in cases of cleidocranial dysostosis may be caused by scoliosis, a contracted, deformed, or asymmetric pelvis, coxa vara, or defective feet.

Visceral defects, such as prolapse of the uterus in a virgin and inguinal hernia, have been reported.

DEVELOPMENT OF SKULL AND CLAVICLES

The development of the skull and clavicles may throw some light on the abnormalities in this syndrome.

The clavicle is the first bone to ossify in man. This process is the subject of dispute and speculation. A center of ossification is known to exist in the clavicle as early as the fifth week of fetal life. Bone is developed either in membrane or in previously formed model of hyaline cartilage. Most investigators feel that the clavicle is morphologically composite, partly formed in membrane and partly in cartilage.

The frontal bone, parietal bones, portions of the temporal bones, the bones of the face, and part of the occipital bone are formed in membrane. Therefore, we see that cleidocranial dysostosis usually affects most of the bones formed from membrane, but bones formed by endochondral ossification may also be affected.

From work done by Todd, it would appear that if the time for certain developmental growth passes without its appearance, it would be eliminated

from the growth pattern. He expressed the opinion that growth is local and discontinuous and not uniform and continuous. Therefore, if certain areas do not develop the normal amount on time, they are likely to be defective permanently.

ETIOLOGY

Nothing definite whatever is known of the etiology of this condition. At the present time cleidocranial dysostosis is considered to appear spontaneously as a mutation and may be transmitted, becoming a dominant Mendelian characteristic. Cases have been recorded showing the transmission through four generations. In the study of genetics it has been demonstrated that characteristics appear spontaneously and are transmitted to offspring, then disappear by crossbreeding.

The imbalance of certain chemical constituents in the embryo causing the cranial and clavicular defects is mentioned as a possible cause, just as it is recognized that hemophilia is due to the hereditary absence from, or presence in, the body of certain chemical constituents. Injurious factors, toxic or traumatic, in early embryonic development, causing the chromosomes or genes to be misplaced in the course of development, have been suggested as a possible explanation for this condition. Pressure from amniotic bands in early embryonal life is repeatedly mentioned in the literature. One writer was of the opinion that these malformations might be due to arrested development of individual parts of the embryo at a certain stage with the continued development of the remainder. This, he felt, was due to faulty implantation of the ovum with imperfect fetal nutrition. Another writer suggested that damage to the placenta or to the germ plasm is the main cause of an adverse congenital development. The endocrine glands naturally have been incriminated.

It seems quite evident that many of the above theories are inadequate in the explanation of the pathogenesis because of the combination of malformations. The etiology of this condition will probably be found to explain many other osteodysplastic malformations and anomalies, such as those found in achondroplasia and cretinism.

Sex frequency is about equal. It may be transmitted by either father or mother to either sons or daughters. There are several cases reported where no familial or hereditary histories exist. Cleidocranial dysostosis may be divided into two classes:

1. Cases showing a familial, hereditary deformity of the clavicles with or without other anomalies.

2. Cases showing a nonhereditary, nonfamilial congenital deformity.

TREATMENT

Surgical intervention may be necessary, if there is sufficient pain or functional disturbance in the numerous skeletal anomalies. A bilateral osteotomy was done on the mandible to reduce prognathism in one case.

The dental abnormalities in this condition are challenging. Excellent prophylactic mouth hygiene should be instituted as soon as the condition is recognized. Deciduous teeth should be restored and cared for in the most

approved manner. Intraoral and extraoral radiographs are indispensable and should be taken frequently. All extractions should be preceded by thorough investigation and study. Extraction of all the deciduous teeth is contraindicated as this does not promote the eruption of the permanent teeth. Any permanent teeth that do erupt should receive the best possible treatment in order that they may be used in the retention of fixed bridges and partial dentures. If it becomes necessary to remove any of these teeth, the operator should be forewarned and prepared for the surgical removal of the apical portions of the roots as many are distorted, curved, or crooked. A thorough endocrinologic investigation should be made along with a complete blood study. Then treatment should be given as indicated.

In one or more cases where a hypothyroid condition existed, eruption of the permanent teeth was secured by the administration of thyroid extract. In the few cases where vitamin therapy has been tried, the teeth have not been stimulated to eruption. Orthodontic treatment has been attempted in some cases with rather discouraging results, but this should not deter orthodontists from making every effort to get desired results. Construction of suitable prosthetic appliances, after careful planning, is the best treatment even though the jaws contain many unerupted teeth.

MEDICOLEGAL ASPECT

The medicolegal aspect is of importance. Thoroughly trained and competent roentgenologists have diagnosed at least three of these cases as "ununited fractures." There is a reported story of an Englishman who earned a living by collecting from public concerns for supposed injuries to his clavicles, always submitting x-rays for proof.

DIFFERENTIAL DIAGNOSIS

Cleidocranial dysostosis must be distinguished from the following:

1. Intrauterine fracture of the clavicle
2. Traumatic fracture of the clavicle at delivery
3. Fracture of the clavicle after delivery
4. Hydrocephalus
5. Infantile rickets
6. Prenatal syphilis
7. Craniofacial dysostosis
8. Achondroplasia
9. Osteogenesis imperfecta
10. Cretinism
11. Anodontia

1. Intrauterine fracture of the clavicle is rare and may be entirely associated with osteongenesis imperfecta.

2. Traumatic fracture of the clavicle at delivery unites readily without complications.

3. In fracture of the clavicle after delivery the history of trauma or injury and the absence of the other features should be sufficient evidence to rule out cleidocranial dysostosis.

4. Hydrocephalus is usually congenital, marked by an extensive effusion of cerebrospinal fluid into the cerebral ventricles, dilating these cavities, thinning the brain, and causing a separation of the cranial bones. The head appears enlarged so that only a small shrunken face is seen, surrounded by a large dome-shaped cranium. The intracranial pressure causes separation of the cranial bones with tense bulging fontanels. The absence of a clavicular deformity in this condition should prevent any confusion with cleidocranial dysostosis.

5. Faulty dentition, poorly developed jaws, prominent bosses, and incomplete ossification of the skull might be associated with infantile rickets, but agenesis of the clavicles would not be a symptom of this disease.

6. Prenatal syphilis may cause prominences of the skull and hypoplasia of the teeth, symptoms of the dystrophy we are studying.

7. Craniofacial dysostosis, also called Crouzon's disease, is characterized by (1) cranial malformations, (2) facial deformities, and (3) ocular disturbances. The skull has been variously described as dome-shaped, oxycephalic, trigonocephalic, and scaphocephalic. The sutures may be obliterated and the bones thin.

Hypoplasia of the maxilla, atresia of the nasal fossae, wide-bridged nose, and short upper lip, may be noted in the facial deformities. Like cleidocranial dysostosis, the bones of the face are small in comparison to the bones of the calvaria. The sinuses may also be underdeveloped. Ectopic development of the teeth, retarded eruption, and Class III (Angle) malocclusion have been reported.

The ocular disturbances consist of protrusion of the eyeballs, increased distance between the pupils, divergent strabismus, and later, choked discs and total atrophy of the optic nerve.

Inasmuch as the dental abnormalities and the facial deformities of this condition are very similar to cleidocranial dysostosis, much confusion exists. Thoma incorrectly groups them as one disease.

8. Achondroplasia (chondrodystrophia foetalis) is a disturbance in the normal process of ossification in cartilage resulting in arrested growth of the long bones producing dwarfism. The extremities are disproportionately short in comparison with the torso. Bones of the head formed in membrane are also affected. The head is brachycephalic with a restricted base which causes retraction of the root of the nose. A receding maxilla with mesioclusion accompanies a flat palate which tilts upward in the anterior part. The mandible appears prognathous because of the receding maxilla. Corners of the mouth point downward. The bulging forehead, due to the peculiar calvarial contour, the sunken midportion of the face, and the protruding mandible, give a flattened facial appearance. Tardy eruption and exfoliation of the deciduous teeth are noted. Retardation of the permanent dentition, as well as disorganization of the normal arrangement, is recorded. Again we have a dental picture similar to that observed in cleidocranial dysostosis.

9. Osteogenesis imperfecta, frequently known as fragilitas ossium, idiopathic osteopsathyrosis, or periosteal aplasia, is characterized by a congenital defect in osteoblastic evolution. It is recognized by defective ossification of the cranium and multiplicity of fractures resulting from trivial causes. These fractures are due to a deficiency of osteoblasts and to excessive osteoclastic

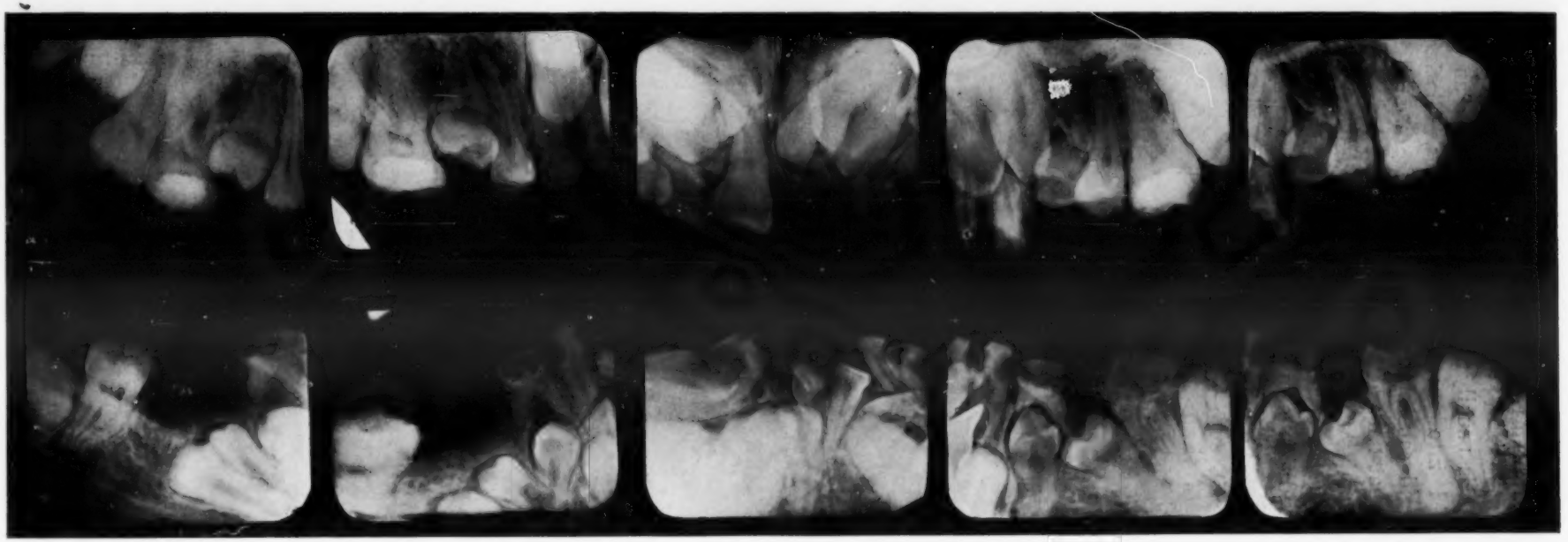


Fig. 1, Case 1.—Set of dental radiographs at age 21 years.

activity, and not to the lack of organic constituents of the bone. There is apparently no disturbance in the blood chemistry. Marked hypoplasia of the dentine underlying normal enamel is frequently found. The teeth may be transparant so that the pulps are seen.

Pathologically, there are two types classified as congenita and tarda forms. The majority of patients with osteogenesis imperfecta congenita are born with numerous fractures. Defective membranous bone development results in a parchment-like skull with many Wormian bones. Lack of ossification with wide sutures and fontanels is noted at times. Cases of osteogenesis imperfecta tarda give hereditary histories. Some present the classic blue sclerae and a few deafness. Disturbed osseous development of the long and short bones and of the skull with wide sutures may be found.

10. In cretinism, the head is large and brachycephalic in type. Delay in the dentition of both deciduous and permanent teeth is noted. There is usually a long period of open fontanels and sutures. These symptoms and diminished stature are the most important characteristics that this disease has in common with cleidocranial dysostosis.

11. Some cases of partial or complete anodontia might be confused with the dental defects of cleidocranial dysostosis. True anodontia, caused by ectodermal dysplasia, presents a normal calvaria. A saddle-shaped nose and the lack of teeth give a senile expression.

Aplasia and hypoplasia of the dentition may be considered a part of general ectodermal abnormal development. Elephantiasis of the gingivae, anhidrosis, alopecia, and malformation of the iris and fingernails are frequently associated with anodontia. Hypertrichosis may be found in conjunction with gingival hypertrophy and noneruption of the teeth. Noneruption of several permanent teeth has been noted in cases of leontiasis ossea.

In a few cases of irradiation of pregnant women for pelvic disease, suppression of the dentition in the offspring has been noted.

Delayed eruption of the teeth may be associated with hypogonadism or hypopituitarism.

CASE REPORTS

I have been unable to find more than 250 cases described as cleidocranial dysostosis in the literature.

There are about twenty reported families which can be identified with hereditary defects.

CASE 1.—On Aug. 31, 1940, S. P., a white married woman, aged 28 years, presented herself for dental examination. The patient was the youngest and the smallest of eleven children, nine of whom were living and well. There was no history of any bone abnormality in the family. Her mother was of Swedish extraction, and died at the age of 55 of erysipelas and possibly diabetes. Her father was of Finnish extraction and died at the age of 57 of a carbuncle. The patient knows nothing of her delivery. She was 8 years old before starting school because of her undersize. Her fontanels did not close until she was four years of age. Abnormal mobility of her shoulders had existed since birth. Her only illnesses were measles at 16 years of age and scarlet fever at 20 years of age, with no complications. She has been married six years. Her

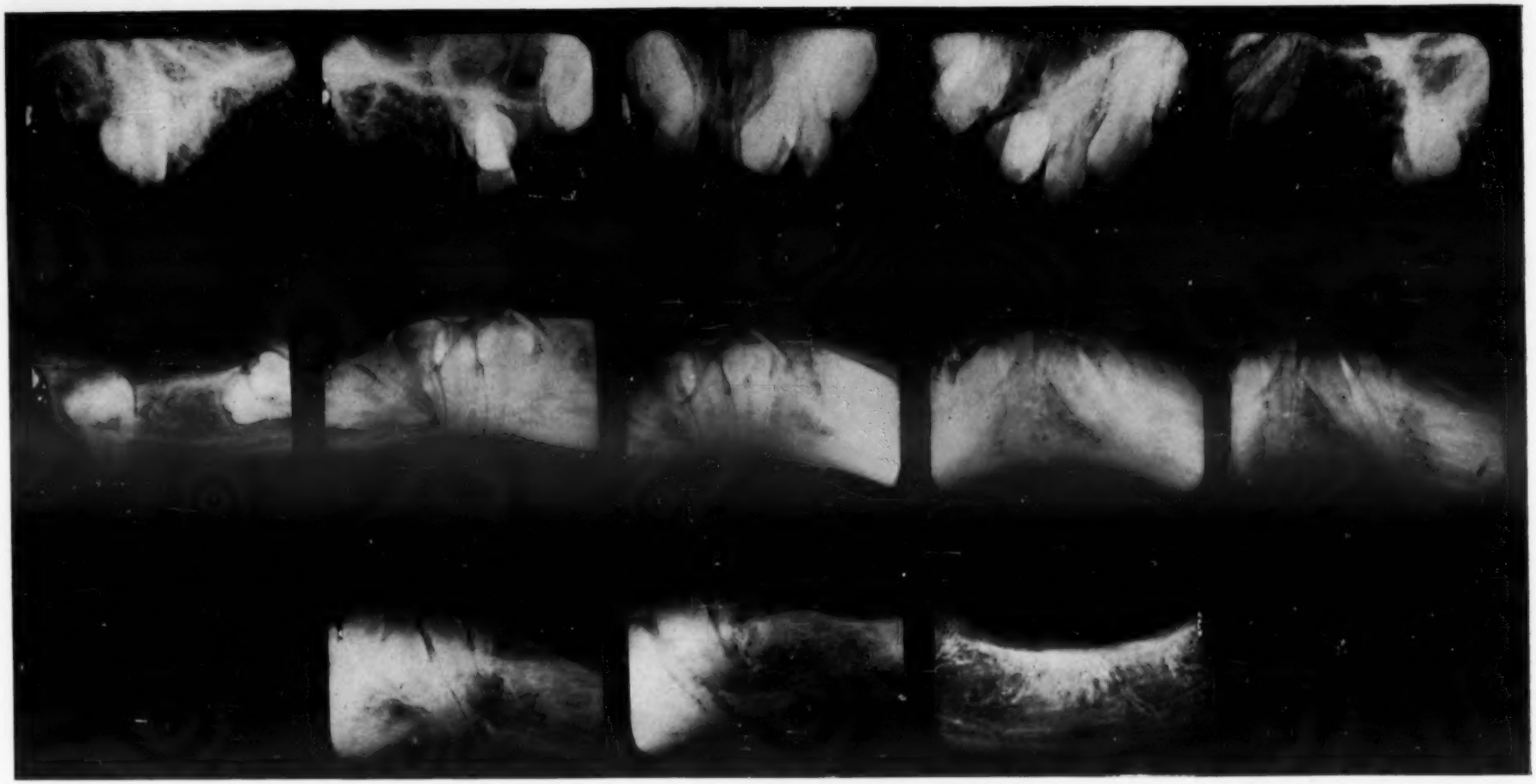


Fig. 2, Case 1.—Set of dental radiographs at age 28 years.

husband is living and well with normal body build, height 69 inches, weight 145 pounds. She has had three pregnancies. The first infant, a boy weighing 7 pounds, 11 ounces, was delivered by midforceps after a second stage of labor lasting eight hours. Death occurred twenty-four hours later from an intracranial hemorrhage. Tears of the right and left tentorium cerebelli were found at autopsy. There was no evidence of cleidocranial dysostosis noted. Two living children, Cases 2 and 3, were delivered by low cervical two-flap cesarean sections.



Fig. 3. Case 1.—Lateral pelvis and sacrum during second pregnancy.

The patient remembers having had several deciduous teeth filled at the age of 6 years. Ten years later, after having had many more teeth restored by fillings, it was necessary to remove three deciduous teeth because of caries. When she was 19 years old, many more deciduous teeth were extracted and two partial dentures—one upper, one lower—were inserted. She wore these two years. Then the patient had her mouth radiographed and the remaining

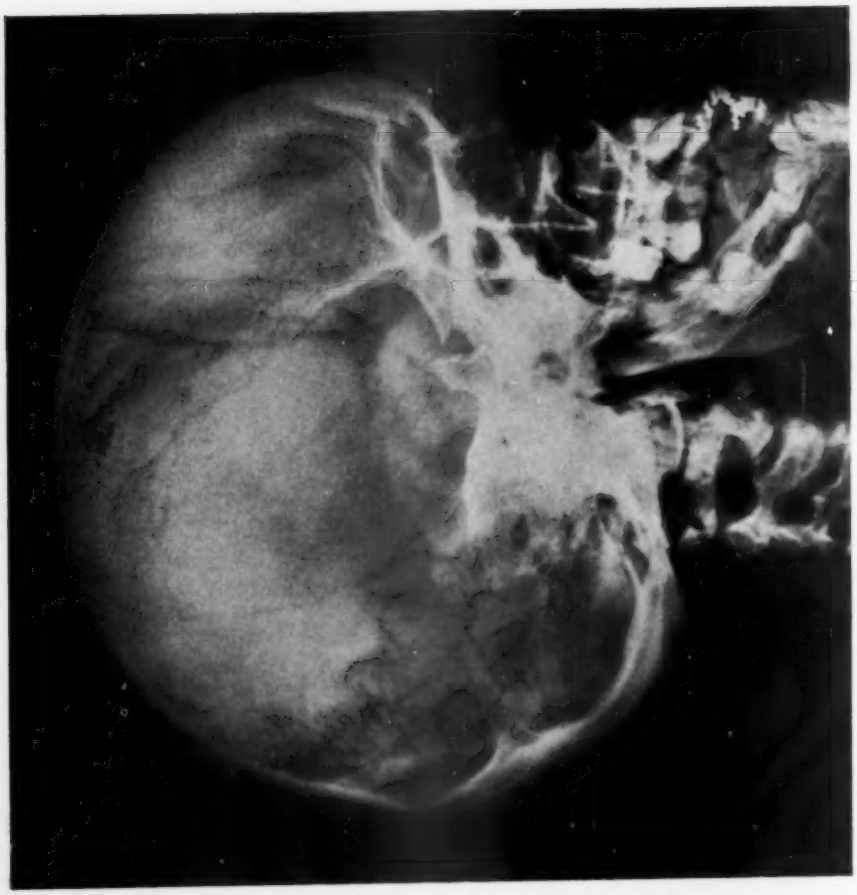


Fig. 5, Case 1.—Lateral skull.

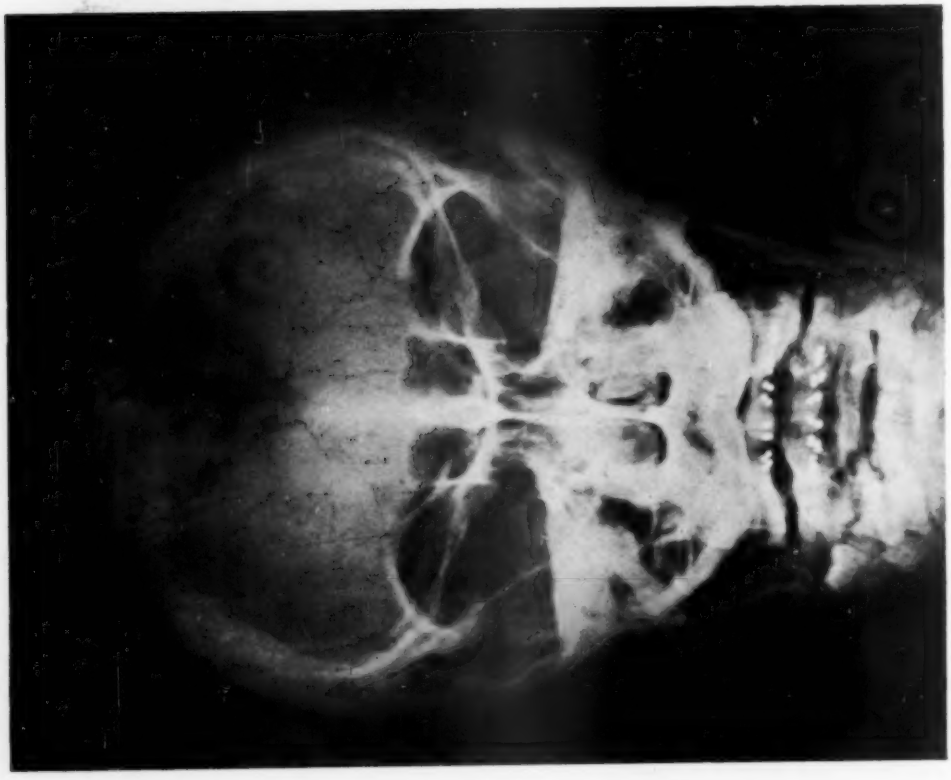


Fig. 4, Case 1.—Skull, anteroposterior.

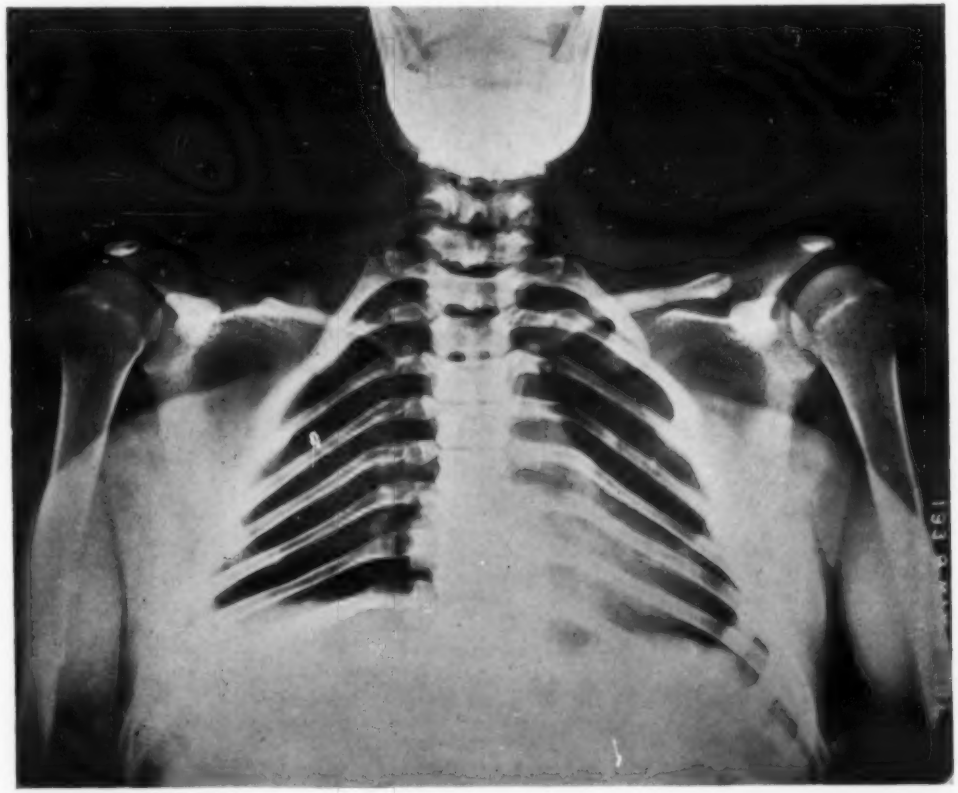


Fig. 6, Case 1.—Thorax.



Fig. 7, Case 1.—Lumbosacral spine and pelvis.

deciduous teeth and a few permanent teeth, which had erupted, were removed. Shortly after, full dentures—upper and lower—were inserted. She has been wearing these for the past eight years. During her twenty-third year, a mandibular anterior tooth erupted which was removed. At the age of 26, a mandibular left molar erupted and was extracted, and on Sept. 20, 1941, three years later, a maxillary right incisor, which had appeared through the mucous membrane, was removed.



Fig. 8. Case 1.—Lateral lumbar spine during second pregnancy.

A general physical examination, done on Sept. 24, 1941, revealed the patient to be 56¾ inches tall and weight, 75 pounds. Her head was large in proportion to the rest of her body with the circumference being 22.5 inches (571 millimeters); the length, 7.4 inches (189 millimeters); the width,

5.6 inches (144 millimeters); with a cephalic index of 76.1. The frontal and parietal bosses were prominent with an obvious deep frontal groove. The hair on her head appeared heavy, her pupillary distance was 2.2 inches (60 millimeters), her nose was slightly broad at the root, and her ears showed no pathologic condition. Her tonsils had been removed; no cervical adenopathy or thyroid enlargement was noted. Her face was small, the maxilla being underdeveloped, and the mandible slightly prognathous. She was wearing full upper and lower artificial dentures. The mucous membranes of her mouth were some-

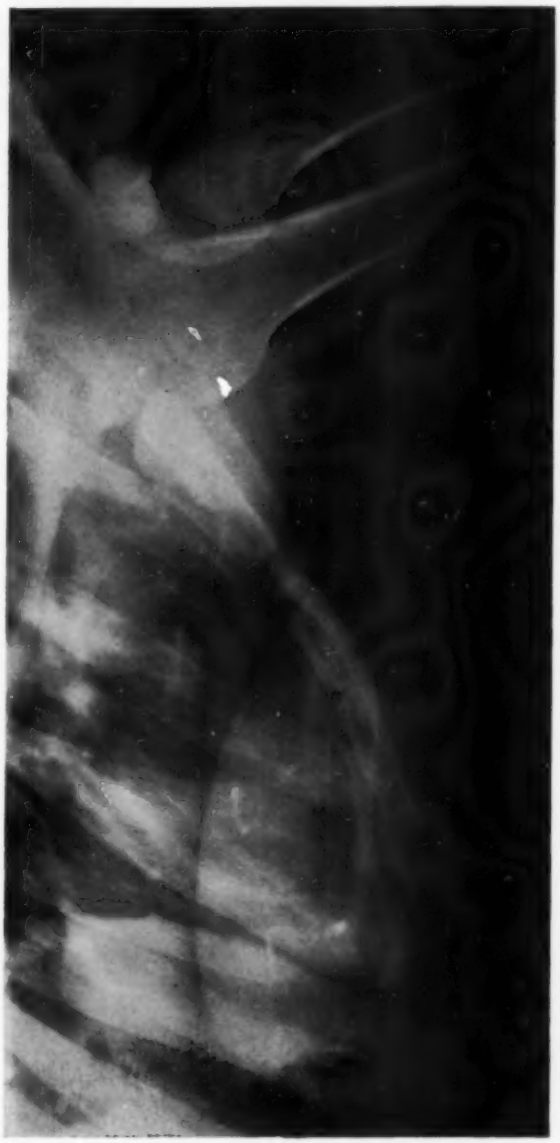


Fig. 9, Case 1.—Lateral sternum.

what inflamed where they were in contact with the dentures, and particularly so in the maxillary right lateral region where the incisal edge of a tooth was visible. The palatal vault was relatively high. A full-mouth set of radiographs revealed eight unerupted teeth in the maxilla and ten in the mandible. Both clavicles were deficient at the acromial ends allowing unusual mobility of the

shoulders. The chest measured 28 inches on expiration and 29 inches on inspiration; the humerus, 10¼ inches; the femur, 15½ inches; the tibia, 13 inches. There was a lordosis of her spine and marked prominence of the buttocks. Examination of the heart and lungs revealed no abnormal condition. The systolic blood pressure was 90 millimeters and the diastolic 70 millimeters of mercury. The abdomen measured 23 inches with two median scars visible. The liver, spleen, and kidneys were not palpable. The pelvis, which was small and contracted, has been described by Marshall and Wulff. She wore size 6½ glove and 3½ shoe. The external genitalia were normal and there was normal distribution of female hair. No evidence of rickets was noted.



Fig. 10, Case 1.—Forearm.

Laboratory Report.—The basal metabolic rate was plus 20 per cent. Blood Wassermann was negative; blood sugar fasting 82 mg. per 100 c.c. of blood;

blood urea nitrogen 18.8 mg.; serum nonprotein nitrogen 30 mg.; serum protein 7.3 Gm.; serum albumin 3.7 Gm.; serum globulin 3.6 Gm.; blood chlorides as NaCl 514 mg.; blood calcium (total) 10 mg.; calcium ionizable 4.3 mg.; calcium unionizable 5.7 mg.; blood phosphorus 3.22 mg.; phosphatase 1.94 Bodansky units; blood cholesterol 200 mg.; blood grouping International type O; erythrocyte count 4,180,000; leucocyte count 8,300; hemoglobin 70 per cent or 11 Gm. per 100 c.c., Haden Hauser method; color index 0.8; polymorphonuclear leucocytes 71 per cent; lymphocytes 29 per cent; sedimentation rate 14 mm., Cutler method; coagulating time 3 minutes; bleeding time 1½ minutes. Urinalysis was as follows: straw color; pH 6.5; albumin negative; sugar negative; specific gravity 1.020; microscopic negative. The calcium precipitability in the urine was within normal limits. The hydrogen-ion concen-



Fig. 11, Case 1.—Left foot.

tration of the saliva taken by the glass electrode meter was 7.53. The electrocardiogram showed normal sinus rhythm; rate 60; PR interval 0.16; P waves normal; QRS waves normal with slight left axis deviation; T_1 and T_2 upright and normal; T_3 isoelectric; Lead IV normal except for loss of normal S wave.

Radiographic Report.—The facial bones were underdeveloped. Numerous Wormian bones were present in the posterior parietal and occipital areas. Both mastoid processes were entirely nonpneumatic and appeared densely sclerosed. The dorsum sella was massive. Both the posterior and anterior fontanels showed no evidence of closure or ossification and were unusually conspicuous. The outer half of the right clavicle was missing and also the outer third of the left



Fig. 12, Case 1.—Right and left feet.

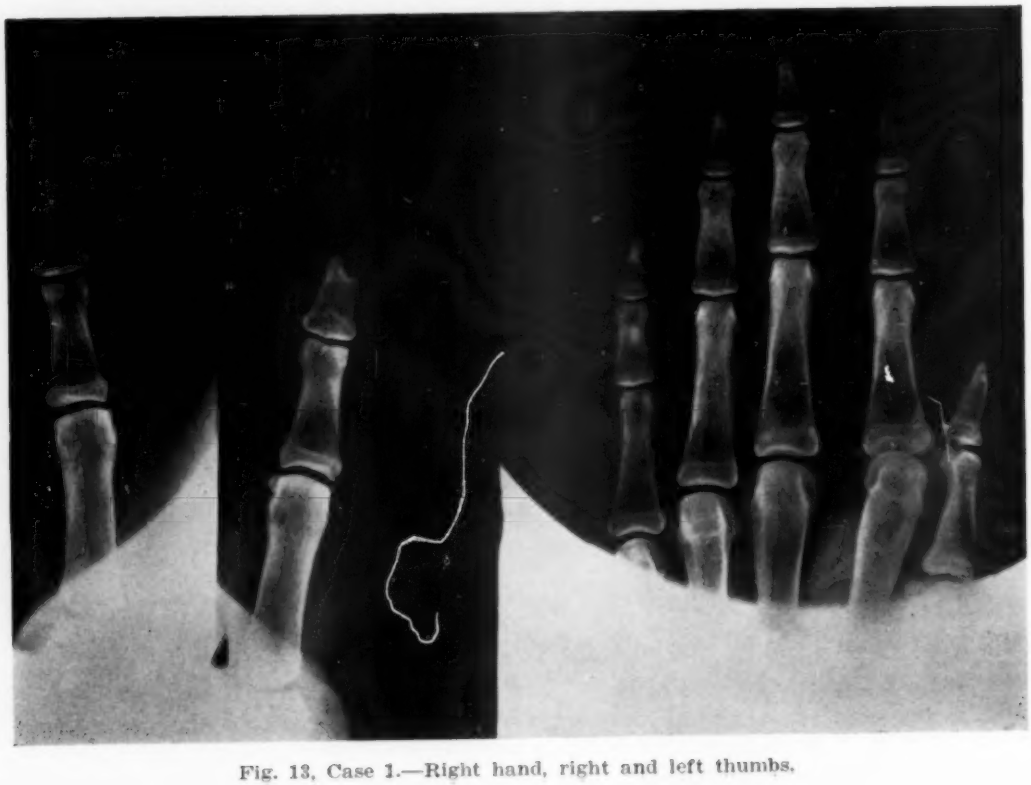


Fig. 13, Case 1.—Right hand, right and left thumbs.

clavicle. The portion of the right clavicle which did appear was much thinner than the left. The ends of each clavicle were well rounded. Her thorax as a whole was truncated. The individual segments of the sternum were widely separated because of incomplete ossification at the various points of junction. In the lumbosacral region there was an increase in the normal lordosis but no spondylolisthesis. The upper portion of the sacrum was tilted forward markedly. There was a wide pubic symphysis due to incomplete ossification of the descending rami of the pubic bones. Both sacroiliac articulations were irregular and unusually wide because of similar incomplete ossification. The iliac crests were also incompletely ossified. The pelvis as a whole was small. Examination by Thoms' grid revealed the pelvic inlet greatly contracted and appearing heart-shaped with a false promontory of the sacrum contributing to the deformity. Epiphyseal lines were visible at the upper ends of both humeri, upper and lower ends of both tibii and fibulae, and at the lower ends of the ulnae and radii. The terminal phalanges of all toes and fingers were sharply pointed and the thumbs showed a distinct notching at the tips.

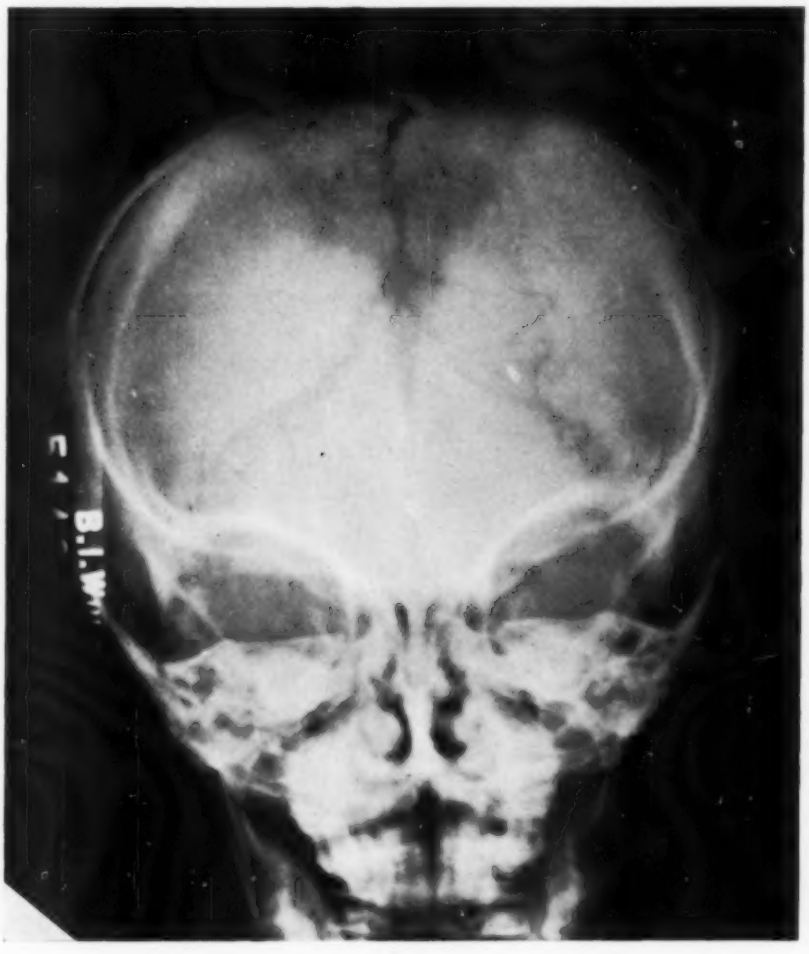


Fig. 14, Case 2.—Skull, anteroposterior.

Case 2.—T. P., son of the patient in Case 1, was delivered by a low cervical two-flap cesarean section on May 23, 1938. He weighed 6 pounds, 9 ounces.

The outer two-thirds of the right clavicle were absent, and the left clavicle was found to be slightly longer. The sagittal and metopic sutures were wide open, but there was no bulging of the fontanels. The head was large with the frontal and parietal bosses prominent. In other respects he appeared normal. He was breast fed for one month and since that time, a well-balanced and adequate diet, prescribed by the pediatrician in charge, has been faithfully followed.

Since birth he has had a mucoserous discharge from both eyes. A right inguinal hernia was noticed at the age of two months which responded to medical treatment. He had whooping cough at the age of 1 year and 7 months, without complications. He walked at the age of 15 months, and at 24 months it was noticed that he had flat feet. The mother stated that the first tooth which erupted was a maxillary anterior at the age of 8½ months. By the time he was 15 months old, eight teeth were present, eight more erupting shortly after his second birthday.

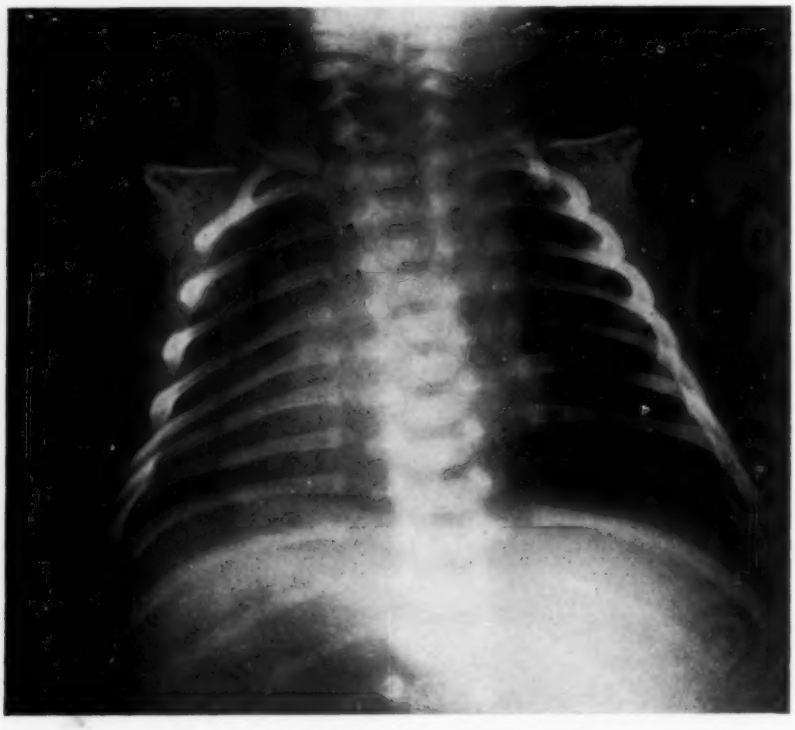


Fig. 15, Case 2.—Thorax, age 14 months.

I first saw him at the age of 2 years and 3 months, at which time I examined his mouth. There were sixteen teeth visible in the upper and lower jaws; namely, the central and lateral incisors, which were fully erupted, and the canines and first molars, which were partially erupted. The palatal vault was high and arched. No irregularity of the occlusion was noted at this time, much infraclusion existing, because of the retarded eruption of the teeth. No caries was evident and the teeth were clean. Instructions in oral hygiene were given at this time to the mother.

At the age of 3 years and 4 months, the patient cooperated so that a dental prophylaxis was accomplished. An examination revealed caries approximally on the mesial surfaces of the maxillary central incisors. The cusps of the two

mandibular second molars were visible while the maxillary second molars could not be seen. The maxillary right lateral incisor was in torsiversion with the distoincisal edge occluding on the lingual side of the mandibular right canine. The maxillary left lateral incisor was in torsiversion but not rotated as much as the right lateral. His mouth hygiene had been good. Subsequently, fillings were inserted in the maxillary central incisors, and casts made from modeling compound impressions.

A physical examination made on Sept. 24, 1941, revealed that his height was 36 inches and his weight, 30½ pounds. The circumference of his head was 20.5 inches (520 millimeters); length, 7.1 inches (182 millimeters); width, 5.3 inches (136 millimeters) with a cephalic index of 74.7. Prominent frontal and parietal bosses were evident. The vertex was somewhat flattened, his forehead broad, and the anterior fontanel and metopic suture were widely opened. The anterior fontanel, which measured 4½ inches anteroposteriorly and 2½ inches wide, was irregular in shape. The nose and ears showed no abnormality, but there was a slight strabismus in one eye. The hair on his head was normal.



Fig. 16, Case 2.—Thorax, age 2 years, 2 months.

His tonsils were moderately enlarged, and slight cervical adenopathy was noted. There was no abnormality of the thyroid gland. His chest was conical in shape. The shoulders presented abnormal mobility because of the absence of the acromial ends of both clavicles, the defect of the right being greater than the left. Examination of the scapulae, sternum, ribs, spine, heart, and lungs did not yield observations of importance. There was no evidence of rickets. The only deformity noted in the extremities was flat feet.

Laboratory Report.—The blood grouping was international type O; coagulation time 3 minutes; bleeding time 3 minutes; erythrocyte count 3,430,000; leucocyte count 5,400; hemoglobin 64 per cent or 10 Gm. per 100 c.c., Haden Hauser method; color index 0.8. The Schilling hemogram showed 23 per cent polymorphonuclear leucocytes; 1 per cent eosinophiles; 2 per cent stab cells; 20 per cent segmented cells; 76 per cent lymphocytes; 1 per cent monocytes.

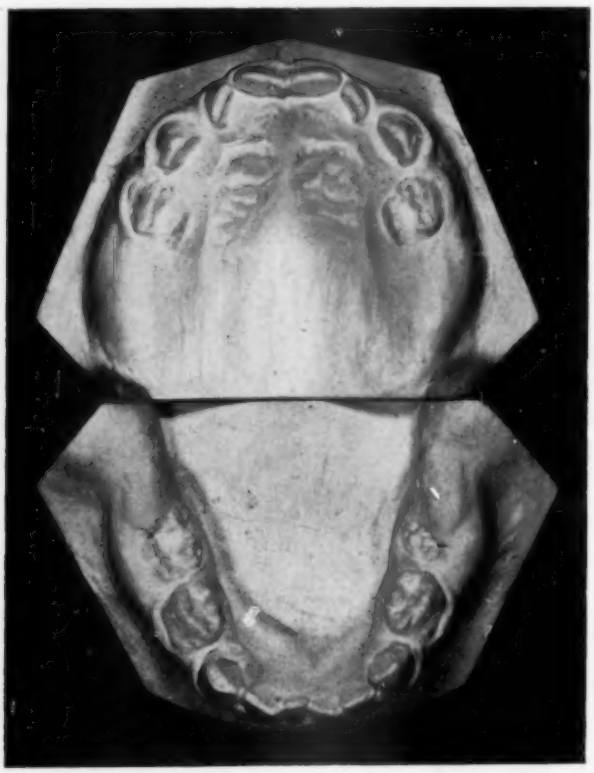


Fig. 17, Case 2.—Casts made at the age of 3 years, 4 months.

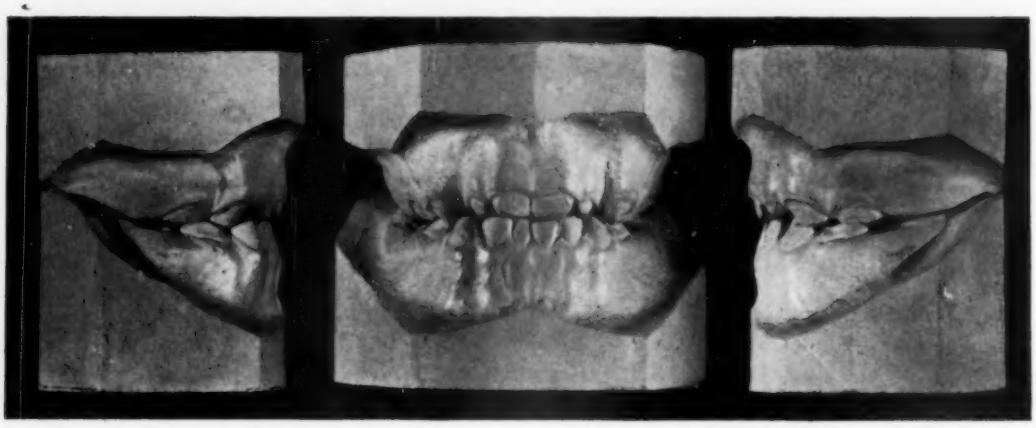


Fig. 18, Case 2.—Casts made at the age of 3 years, 4 months.

Urinalysis was as follows: Color amber; aromatic odor; clear consistency; specific gravity, 1.017; occasional white blood cells and epithelial cells; small amount of mucus; few amorphous phosphates; no casts; slight alkaline reaction; negative for albumin, sugar, occult blood; faint trace of bile. The calcium

precipitability in the urine was within normal limits. The hydrogen-ion concentration of the saliva taken by the glass electrode meter was 8.02. On June 30, 1942, his activated saliva was examined and found to contain 250 Lactobacillus acidophilus organisms per cubic centimeter.

Radiographic Report.—The bones of the calvaria showed incomplete ossification with a huge anterior fontanel. The outer third of the right clavicle and the outer fourth of the left clavicle were missing. The portion of the left clavicle which did appear was heavier than the right clavicle.

Case 3.—P. P., daughter of the patient in Case 1, was delivered by a low cervical two-flap cesarean section on Nov. 10, 1940. She weighed 6 pounds and 2 ounces. Her frontal and parietal bosses were prominent, and the fontanels were widely open. On palpation, slight failure of ossification at both ends of the right clavicle was noted.

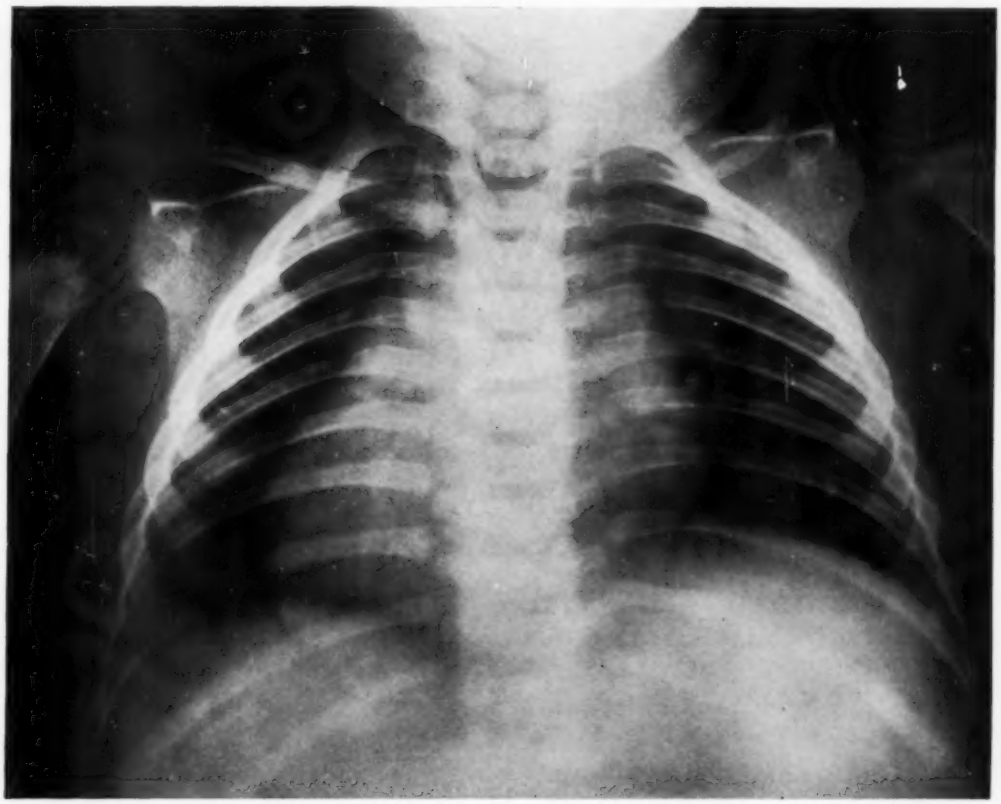


Fig. 19, Case 3.—Thorax.

She was breast fed for one month, and since that time the dietary requirements, recommended by the pediatrician in charge, have been faithfully carried out. Her only illness was a severe upper respiratory infection at the age of 6 weeks, for which she was hospitalized. She has had a slight watery discharge from the right eye since birth.

She was brought to my office for a dental examination at the age of 10 months which revealed that only the mandibular central incisors had erupted. The palatal vault was narrow, high, and arched, and the mucous membranes of her mouth showed no abnormality.

At this time a general physical examination was made. She was 26 inches in length and weighed 16 pounds and 9 ounces. The circumference of the head was 17.5 inches (444 millimeters); length, 6.5 inches (166 millimeters); width, 5.1 inches (130 millimeters) with a cephalic index of 78.3. Her chest measured 16¾ inches. The head appeared large with prominent frontal and parietal bosses. The anterior fontanel was large and continuous with the sagittal suture; the posterior fontanel was open. No evidence of rickets was observed. On palpation the right clavicle was found defective at both the acromial and sternal ends. No other abnormalities or pathologic conditions were found.

Laboratory Report.—The routine microscopic and chemical examination of the urine revealed no abnormal findings. The calcium precipitability in the urine was within normal limits.

Radiographic Report.—The outer fourth of the right clavicle and also the inner fifth were absent. The left clavicle was normal. The portion of the right clavicle which was present was thinner than the left.

COMMENTS

The early investigators considered cleidocranial dysostosis an isolated defect of the skull and clavicles. Although these may be the most constant and conspicuous features, it is now felt that the condition is a generalized anomaly which involves the whole organism. However, the symptoms and usage justify the retention of its original name.

Fitchett was of the opinion that the condition was not necessarily hereditary, since many cases have been observed where no members of the immediate family were affected. He stated that it would simplify our conception of the disease if we called it "congenital cleidaldysostosis," either hereditary or nonhereditary, and with or without other anomalies. His point was that some cases showed only clavicular defects with skull changes, and, even with careful examination and investigation, the hereditary factor could not be proved.

Cases presenting skeletal deformities and dental abnormalities without clavicular dysplasia must not be classified as cleidocranial dysostosis. My cases are typical because they fulfill Marie and Sainton's four cardinal diagnostic criteria plus other anomalies. These case studies will again be reported from time to time in order to record any treatment instituted.

Almost every striking case which has been thoroughly radiographed, shows the unerupted teeth coexisting with the other features. This delayed eruption raises two important questions:

1. In the mouths of patients where one or more teeth have been delayed in their eruption, is there an expression of some growth problem which should be more thoroughly studied?

2. Inasmuch as we do not understand the process of eruption of teeth, does this condition explain why teeth do or do not erupt?

Because of these two questions, I believe that cleidocranial dysostosis presents dental problems which challenge us to make a complete investigation and study.

Defective dentition plays as important a role in this syndrome as defective ossification.

The mandible is the second bone to ossify and the maxillae follow. Whether or not this has anything to do with the disturbed genesis and the noneruption of the teeth is problematical.

One author expressed the opinion that the eruption of the teeth was influenced by the growth of bone, and any dysostosis was produced by improper calcium metabolism.

Several concomitant forces such as the growth of the jaws, the behavior of the epithelial tissue surrounding the teeth, and possibly even the elongation of the roots could influence the process of eruption of the teeth. Normal growth of alveolar bone may be the primary factor in the normal eruption of the teeth. It would seem possible to ascribe the appearance and behavior of the teeth which fail to erupt to a partial defect of the bone resorption mechanism of the jaws.

If there are no mechanical obstacles to the eruption of several teeth in a patient, some disturbance such as cleidocranial dysostosis may be suspected.

Notwithstanding the numerous bony defects, these patients appear to be unusually well and healthy.

There is a high percentage of palatal clefts in cases of cleidocranial dysostosis.

Attention of the dental profession is especially invited to abnormalities in such conditions as cleidocranial dysostosis, achondroplasia, and craniofacial dysostosis where the dental anomalies are quite similar and correlated with the anomalies of the skeleton. Most cases of cleidocranial dysostosis do not consult the medical profession as they consider themselves normal and are usually free from any discomfort; whereas, the dentist will be confered with frequently because of the magnitude of the dental problem. The number of abnormalities noted by either profession varies with the thoroughness of the examination and the keenness of the observer.

If more cases of this condition were brought to light, and thorough investigation inaugurated, perhaps, the severity of the dental deformities could be alleviated.

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AN ANTHROPOLOGIC STUDY OF FACE HEIGHT

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INTRODUCTION AND REVIEW OF THE LITERATURE

FACIAL height has of necessity long been of interest to the dentist, since the esthetic and functional requirements of his work presupposed at least a working familiarity with this feature of the human physiognomy. In the replacements made for edentulous individuals or in cases where a partial or complete natural dentition is present but the facial height lessened, the establishment of a normal and functional distance between nose and chin becomes clinically an urgent problem. This problem is generally "solved" empirically by the use of the intangible method known as "clinical judgment." Since the faces and dimensions of individuals differ so markedly, recourse was of necessity made to clinically observable signs such as the tenseness and fullness of the lips, the contours of the lower third of the face, etc., when determinations were made of the space to be occupied by the prosthetic substitutes. Subsequently the distance determined could be shortened slightly by grinding the cuspal areas of the restorations. There appeared to be no common denominator for restoration of the original facial height once it had been lost.

With the advent of the Broadbent-Bolton cephalometer, it become possible to record and study large groups of patients both cross-sectionally and longitudinally. Using this method Brodie found that while the actual measurements of facial height from nasion (N) to gnathion (GN) varied considerably between individuals, the relative proportions of the parts composing the total heights were very similar in all persons studied, as well as at various ages in the same individual and in different individuals. He states, "The nose (the area between N-ANS) seemed to show such stability in pattern and growth that an effort was made to determine the proportional extent of its contribution to growth. It was found that after 1½ to 2 years of life it constituted 43 per cent of the total height of the face in the growth range represented by the present study. Range in percentage was so narrow that curiosity impelled a search into different ages and conditions. Dr. Thompson, a graduate student, found a mean of 43.8 per cent, while Dr. Stapf, another graduate student, obtained an identical mean from 40 malocclusions belonging to Class III type. It is interesting to note that Brash, comparing the skull of a newborn infant with that of an adult, gave 41.3 per cent for the former and 42.85 per cent for the latter."

Examination of the skulls measured revealed great differences in the degrees of attrition of the teeth. It is thought that as the human teeth wear in the process of mastication they erupt a corresponding amount. The distance from the anterior nasal spine (ANS) to GN would therefore not be expected to change because of the attrition of the teeth. The concomitance of eruption

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and attrition has been experimentally demonstrated in the rat molar by Schour and Hoffman.

OBJECT

It therefore became our purpose to test by an anthropometric method:

1. Whether or not the radiographic findings of Brodie hold true in the adult as well as in children.
2. The effect of attrition on the facial height.
3. What variations, if any, exist as between racial groups.

METHODS AND MATERIALS

The adult human skull specimens* examined were from the collection of the Department of Anthropology, Field Museum of Natural History and from the Department of Anatomy of the University of Illinois.

Three hundred twenty-six adult human skulls of which 262 were of known origin were used in this study. The geographic distribution of the skulls of known origin is indicated generally in Fig. 1 and in greater detail in Table I.

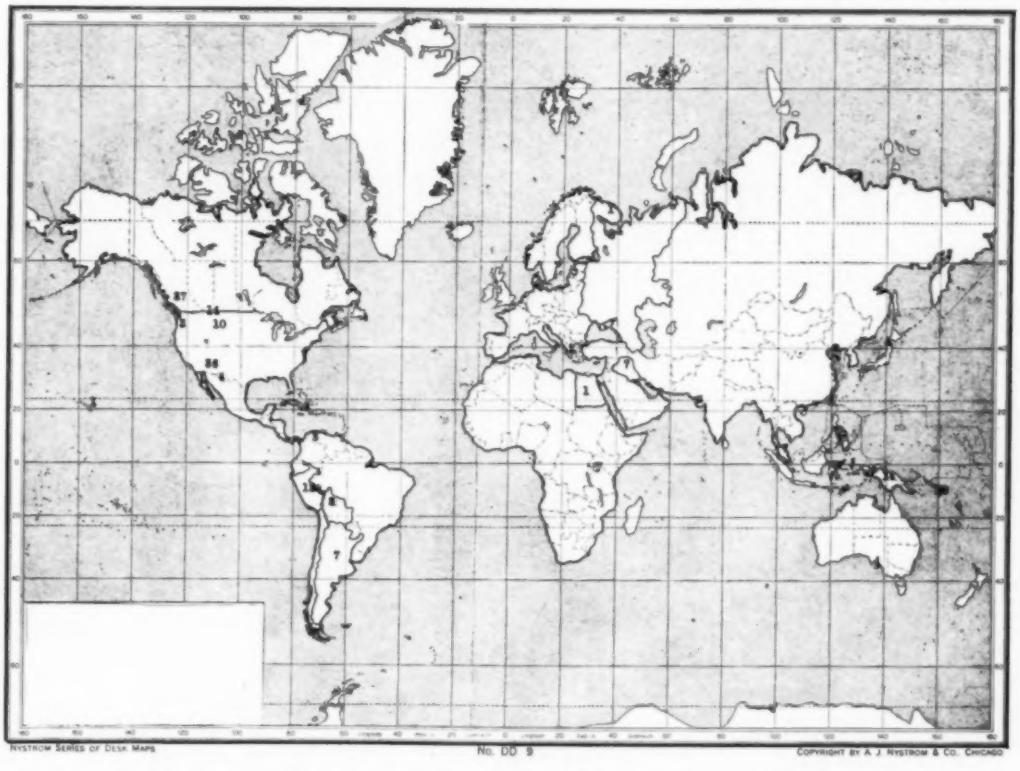


Fig. 1.—Geographic distribution of 262 skulls of known origin. (From the Field Museum.) (Map reproduced by permission of A. J. Nystrom & Co.)

Measurements were made with a hinge caliper from nasion (N) to the anterior nasal spine (ANS), from ANS to gnathion (GN), and from N to GN. (Fig. 2.) After each measurement the caliper was placed in a millimeter rule and the result recorded in millimeters and halves of millimeters. For our

*We wish to thank Drs. Paul S. Martin and Wilfrid D. Hambly of the Field Museum for their kind cooperation in the use of their invaluable skull collections. Our thanks also to Dr. Otto F. Kampmeier, head of the Department of Anatomy, University of Illinois, for the use of his department's skull collection, and to Miss E. Anderson and Miss Harriet Richter for technical assistance.

TABLE I

GEOGRAPHIC DISTRIBUTION OF SKULLS MEASURED, THE MEANS FOR EACH RACIAL GROUP AND THE MEANS FOR ALL SKULLS

LOCALITY	NO. OF SKULLS	N-ANS MM.	ANS-GN MM.	N-ANS PLUS ANS-GN MM.	N-GN MM.	ATTRITION	N-ANS (%)	ANS-GN (%)
Argentina	7	51.35	66	117.35	116.71	3.28	43.85	56.15
Bolivia	2	48.5	68.9	117.1	116.5	3	41.2	58.8
Chicago Negro	1	45	72	117	111	1	38.4	61.6
Egypt	1	52	63	115	112.5	4	44.3	55.7
Hawaii	1	38	50	88	86	1	43.2	56.8
India	1	34	43	77	77	1	44.1	55.9
Iraq	7	52.14	65.35	117.5	116.57	3.28	44.34	
Lapland	1	55	68.5	123.5	121.5	4	44.5	55.5
Malay Peninsula	1	54	70	124	121	3	44.1	55.9
New Britain	39	49.3	64.1	113.4	110.3	2.8	43.4	56.6
New Guinea	14	51	61.1	112.1	110.5	2.8	45.5	54.5
*N. American Indian	107	52.6	69	121.6	119.5	3.24	43.2	56.8
Peru	72	49.5	64.8	114.3	110.2	3.2	43.4	56.7
Philippines	7	48	63.6	111.6	109.28	3	42.9	57.1
San Salvador	1	48.5	70	118.5	116	3	40.9	59.1
Means for skulls of known origin	262	50.75	65.5	116.2	111.7	3.11	43.52	56.48
Means for skulls of unknown origin	64	48.4	63.3	111.7		2.64	43.31	56.69
Means for all skulls	326	50.3	65.0	115.2		3.03	43.51	56.49

*See Table III for detailed distribution and measurements of North American Indians.

purpose we defined facial height as the sum of the distances N-ANS and ANS-GN. In others words (N-ANS) plus (ANS-GN) equals facial height. In each case the percentage of N-ANS and ANS-GN of the facial height was calculated and recorded using the following formulae:

$$\text{N-ANS in \% equals } \frac{(\text{N-ANS in mm.}) \times 100}{\text{facial height in mm.}}$$

$$\text{ANS-GN in \% equals } \frac{(\text{ANS-GN in mm.}) \times 100}{(\text{N-ANS}) \text{ plus } (\text{ANS-GN}) \text{ in mm.}}$$

All measurements were made with the teeth in centric occlusion. Skulls having too few teeth for normal closed relationship of the jaws, those having chipped anterior nasal spines and those with indistinct chin points were discarded.

All of the measurements and calculations in each case were recorded on suitable tally sheets.

Since the teeth were in centric occlusion when measurements were taken and were variously abraded, a record was kept of the degree of attrition seen on each specimen. Attrition was classified as follows (Fig. 3):

Class I—Slight wear of enamel.
Class II—Wear to the dentine cusps.
Class III—Dentine exposed, tooth flat.
Class IV—Tooth flat with cupping of dentine areas.

This classification is a modification of a similar one made by Wassall in 1902 (Fig. 4).

FINDINGS

The results of measurements and calculations can be found in Table I. The total average facial height was found to be 115.2 mm. with a range from

77 mm. to 142 mm. The mean N-ANS distance was 50.3 mm. with a range from 34 mm. to 68.5 mm. and ANS-GN showed a mean of 65.0 mm. and ranged from 43.0 mm. to 84.0 mm. The average attrition was 3.03.

The N-ANS percentage of the facial height showed a mean of 43.51 per cent with a range of from 37.5 per cent to 51.4 per cent. The ANS-GN percentage of the facial height had a mean of 57.49 per cent and range from 48.6 per cent to 62.5 per cent. The number of skulls falling within average percentage groups may be seen graphically in Table IV. The standard deviation was 2.14, and 98.1 per cent of cases fell within three standard deviations on each side of the mean (Fig. 5).

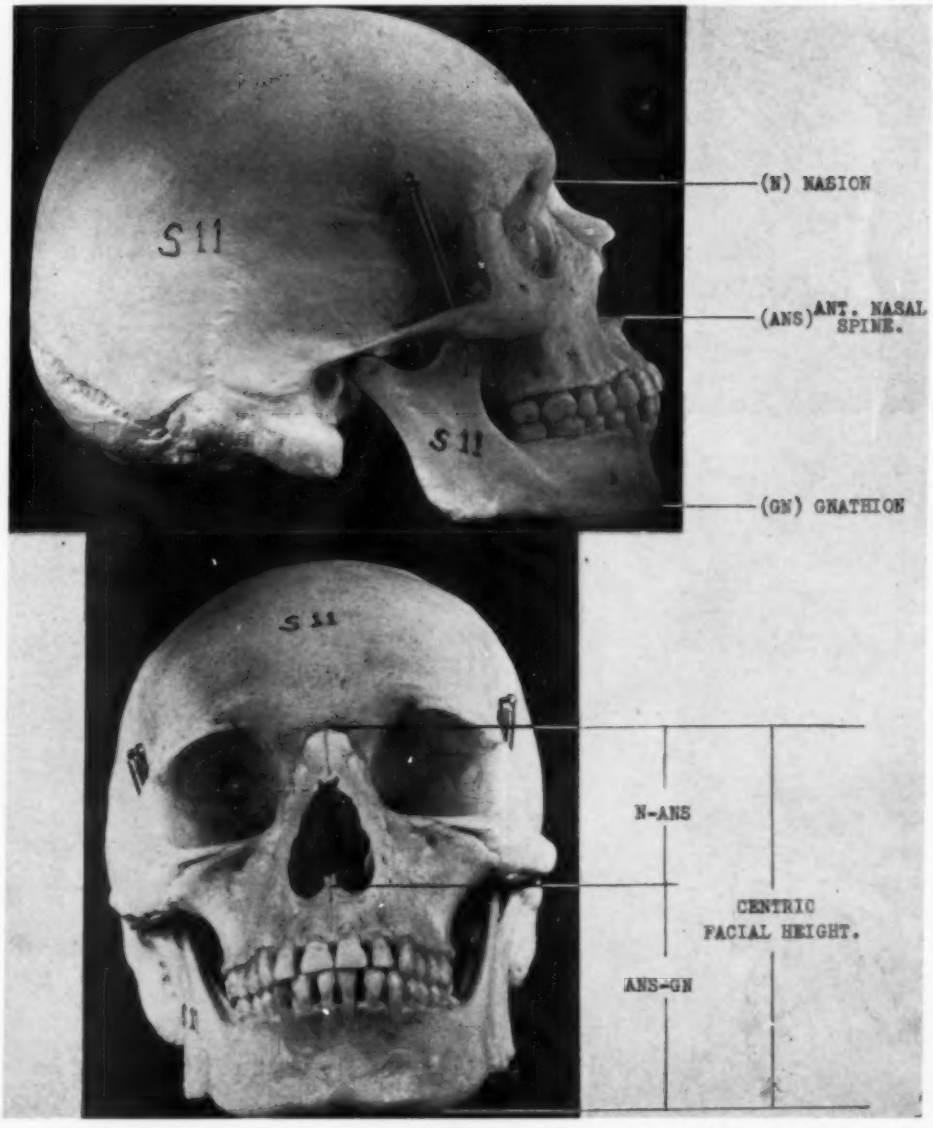


Fig. 2.—The location of all points of measurement. All measurements were made with the teeth in centric occlusion.

The smallest facial height as well as the smallest N-ANS and ANS-GN was found on a skull from India. The largest N-ANS was seen on a skull found

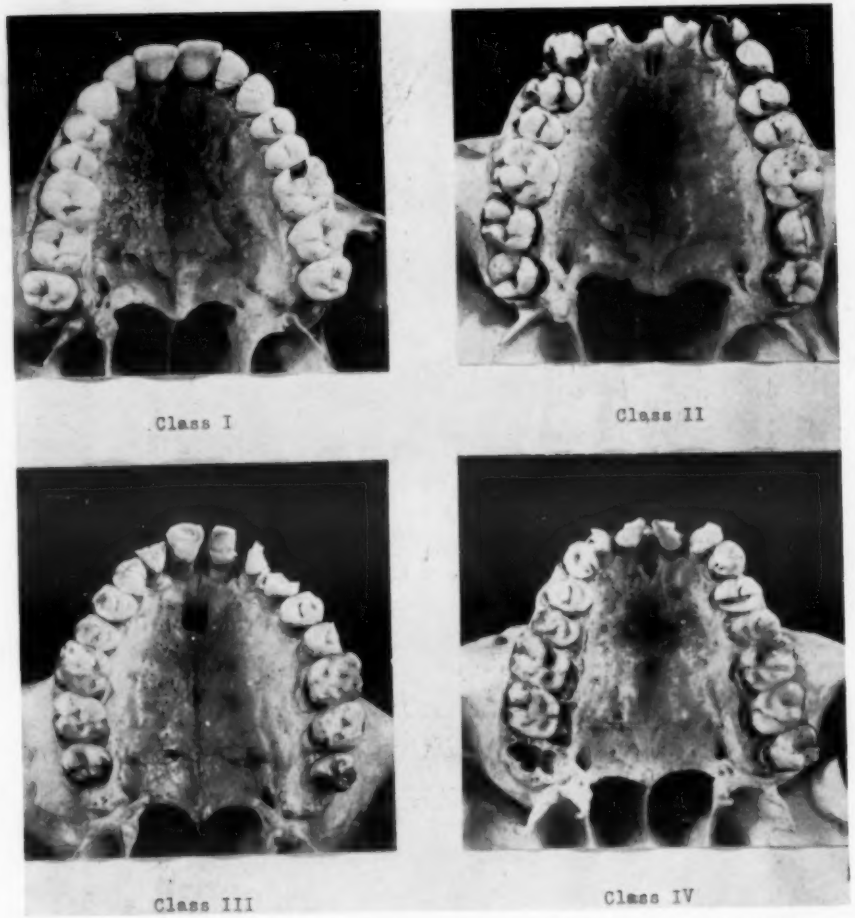


Fig. 3.—Maxillary arches showing examples of each class of attrition.

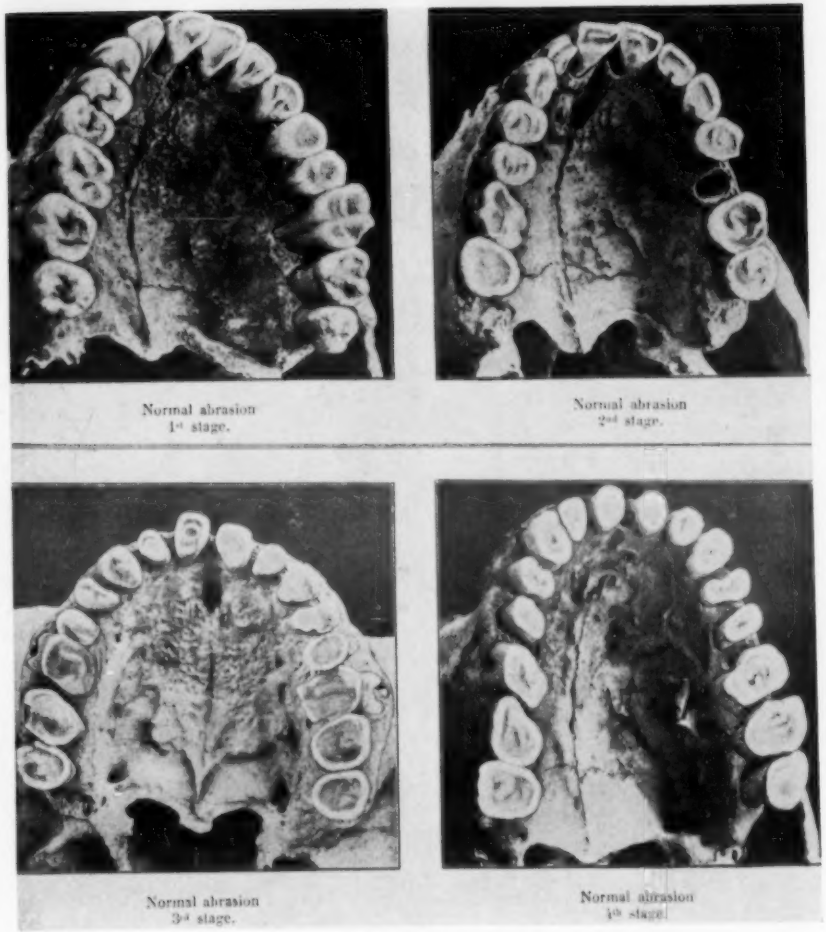


Fig. 4.—Stages of attrition. (After Wassall.)

at Fort Ancient, Ohio. The largest ANS-GN was found on a Songish Indian and the largest facial height was found on a Nootka Indiana (Table II).

TABLE II

RANGE OF DIMENSIONAL VARIATION FOUND ON SKULLS EXAMINED AT THE FIELD MUSEUM OF NATURAL HISTORY

SKULL NUMBER	ORIGIN	N-ANS IN MM.	ANS-GN IN MM.	N-GN IN MM.
43875	India	34.0		
41563	Fort Ancient, Ohio	68.15		
43875	India		43.0	
40509	Songish		84.0	
43875	India			77.0
40669	Nootka			142.0

While the ranges in actual size were large the facial proportions showed no significant differences as between the various groups studied. In those instances where a large number of skulls were measured, the tendency to approach the mean is evident (Table III).

TABLE III

DISTRIBUTION OF NORTH AMERICAN INDIAN SKULLS SHOWING THE CLOSE APPROACH TO THE MEAN FOR ALL SKULLS WHEN THE SAMPLE IS SUFFICIENTLY LARGE

LOCALITY	NO. OF SKULLS	N-ANS MM.	ANS-GN MM.	N-ANS PLUS ANS-GN MM.	N-GN MM.	ATTRITION	N-ANS (%)	ANS-GN (%)
Apache	2	50.2	70.7	120.9	119	4.0	41.7	58.3
Arizona	2	50	77.2	127.2	126	4.0	39.2	60.8
Blackfoot	14	50	65.5	115.5	115.2	3.3	43.9	56.1
British Columbia	6	52.7	63.5	116.2	113.3	3.1	45.3	54.7
California	2	52.5	78	130.5	128	3.0	40.2	59.8
Cliff Dwellers	4	47.6	70.1	117.7	114.6	3.2	41.5	58.5
Fort Ancient, Ohio	2	59.7	73	132.7	126	3.0	44.6	55.4
Haida	30	53.1	71.1	124.2	122.2	3.4	42.7	57.3
Hopi	12	49.3	67	116.3	115.7	3.2	42.3	57.7
Illinois	6	52.5	65.9	118.4	118	2.8	43.7	56.3
Iroquois	2	55.5	65.2	120.7	118.7	2.5	46.1	53.9
Kwakwith	6	56.5	69	125.5	125.4	3.5	43.9	56.1
Nootka	4	53.8	70.7	124.5	123.1	3	43	57
Ojibwi	1	51.5	62	113.5	112	2	45.2	54.7
Oregonian	3	55.5	69.6	125.1	124.1	3	44.3	55.7
Salish	4	53	65.2	118.2	115.5	3	44.8	55.2
Songish	6	53.5	72.6	126.1	121.7	2.8	42.5	57.5
Vancouver Island	1	54.5	58	112.5	110	4.0	48.4	51.6
Average means	107	52.6	69	121.6	119.5	3.24	43.2	56.8
Means for all skulls	326	50.3	65	115.2		3.03	43.51	56.49

The effect of attrition upon the components of the centric facial height can be seen in Table V and graphically in Fig. 6.

DISCUSSION

Before discussing our findings, we think it best to define our terms. As stated above, for our purpose we defined facial height as the sum of the distances from N-ANS and from ANS-GN. All of our measurements were taken with the teeth in centric occlusion. Centric occlusion is defined as that position of the maxillary and mandibular dental arches wherein the inclined planes of the teeth are making maximum contact and the condyles are in centric relation. Swenson defines centric relation as "the most retruded unstrained position of

the heads of the condyles in the glenoid fossae at a given degree of opening." Normally the teeth are in centric occlusion a very small proportion of the time. There exists a definite relation between the position of mandible and the cranium. This is established and held by the musculature and is known as the physiologic

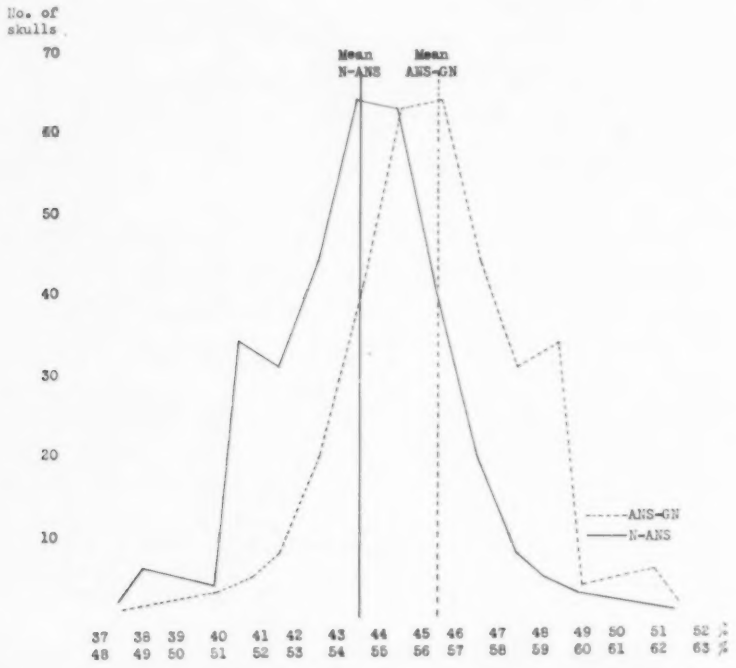


Fig. 5.—Graph representing the frequency distribution of each component of the centric facial height.

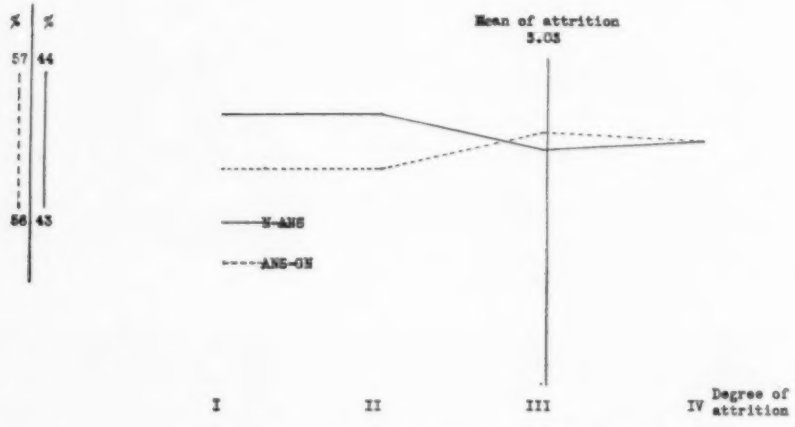


Fig. 6.—Graph showing the effect of attrition upon the components of the centric facial height.

rest position of the mandible. Physiologic rest position is defined as the position the mandible assumes when a tonal balance exists between the muscles which elevate and those which depress the mandible. Normally the mandible is in its rest position most of the time. Only during deglutition or at the conclusion of the masticatory stroke or in voluntary closure do the teeth of the

TABLE IV

TABLE SHOWING THE NUMBER OF SKULLS IN EACH PERCENTAGE GROUP FOR THE COMPONENTS OF THE CENTRIC FACIAL HEIGHT* (SHOWN GRAPHICALLY IN FIG. 5)

NO. OF SKULLS	N-ANS (%)	ANS-GN (%)
2	37.5	62.5
6	38.1	61.9
4	39.9	60.1
34	40.5	59.5
31	41.52	58.45
44	42.46	57.54
64	43.43	56.57
63	44.44	55.56
41	45.4	54.60
20	46.47	53.53
8	47.47	52.53
5	48.16	51.84
3	49.03	50.97
1	51.4	48.6
326		
Means	43.51%	56.49%
Standard Deviation	2.14	
Mean Deviation	1.68%	
Range	14.0%	

*Centric facial height equals (N-ANS) plus (ANS-GN).

TABLE V

THE EFFECT OF ATTRITION UPON THE COMPONENTS OF THE CENTRIC FACIAL HEIGHT (SHOWN GRAPHICALLY IN FIG. 6)

	NO. OF SKULLS	N-ANS PERCENTAGE OF FACIAL HEIGHT	ANS-GN PERCENTAGE OF FACIAL HEIGHT
Class I	23	43.67	56.33
Class II	62	43.67	56.33
Class III	127	43.45	56.55
Class IV	114	43.5	56.5
Means for all skulls measured	326	43.51	56.49

opposing arches come into centric occlusion. The condyles are in centric relation when the mandible is in centric occlusion or in rest position.

In order to clarify the last sentence, a brief review of the mandibular movements from centric occlusion to rest position is necessary. The articular disc of the temporomandibular joint is attached along its periphery to the capsular ligament thus dividing the articular cavity into a superior synovial sac and an inferior synovial sac. The movement of the mandible and its condyle on the inferior surface of the articular disc is hingelike; the condyle does not move anteriorly or posteriorly on the inferior surface of the articular disc. The movement in the superior synovial sac is quite different. As the mandible is depressed from its rest position, the condyle and the articular disc slide anteriorly and downward on the synovial membrane covering the glenoid fossa toward the articular eminence. Therefore the movement allowed by the temporomandibular articulation is both hingelike and sliding. The reason for the temporomandibular joint being classified as a ginglymo-arthroidial joint becomes self-evident. The movement of the condyle when the mandible is depressed from centric occlusion to rest position or from rest position to centric occlusion is of hingelike character. The movement is restricted to the inferior

synovial sac; there is no anteroposterior movement of the condyle and articular disc. When the mandible is depressed past its rest position, the movement of the condyle and articular disc is anteriorly and downward toward the articular eminence—the arthroidial movement allowed by the articulation. Upon elevation the reverse of the opening movement occurs. The movements described are restricted to opening and closing and in a vertical plane.

The distance the mandible moves from rest position to centric occlusion depends upon the distance of the point of measurement from the center of rotation. Normally, the teeth are out of centric occlusion about 2 to 4 mm. in the incisor region when the mandible is in its physiologic rest position. Therefore facial height measurements and proportional relationships between components of the facial height will differ depending on whether the measurements are taken with the mandible in centric occlusion or in rest position. The N-ANS component of the facial height would remain the same in a given individual but the ANS-GN component could differ 2 to 4 mm., depending on whether the measurements were taken with the mandible in centric occlusion or in rest position. In order to differentiate between the facial height existing when the mandible is in centric occlusion or in rest position, the centric facial height should be used to designate the facial height existing when the mandible is in centric occlusion and the term physiologic facial height to designate the height when the mandible is in its rest position.

Brodie et al. made their measurements upon cephalometric x-ray plates made on living subjects. These radiographs of the subject were taken when the mandible was in its physiologic rest position and the physiologic facial height measured. The components of facial height were expressed as a percentage of the physiologic facial height. Since it is impossible to determine the correct rest position in dried skull material, our measurements were taken with the teeth in centric occlusion. The slight differences between our results and those of Brodie are accountable for on the basis of the differences in the positions of the mandible when the measurements were taken. Another difference may be due to the fact that some of the skulls measured may have had a closed-bite relationship, that is, the distance from rest position to centric occlusion exceeded 4 mm. Whether or not this existed in any of Brodie's subjects would not affect the rest position of the mandible in any way.

Our results would lead one to believe that a certain facial height exists which can be considered normal for each individual and that definite proportions exist between the components of the facial height. Our mean cannot be considered as an absolute point to which all measurements must agree or be considered abnormal. A sharp line of demarcation does not differentiate the normal from the abnormal.

What is considered normal exists as a range of possibility deviating upon either side of an established mean. Where normal conditions end and abnormal conditions begin is a matter of opinion and personal judgment. A sharp line of demarcation has not as yet been established. However the problem of positioning the mandible in a vertical plane in order to obtain the correct facial height is a very real one to the dental profession, especially when posi-

tioning the mandible in edentulous individuals. Formerly, the position of the mandible in the edentulous individual could be anywhere from the extreme open mouth position to a point where the edentulous ridge of the mandible touched the edentulous maxillary ridge.

Our findings along with those of Brodie established the fact that there exists a certain relationship between the mandible and the rest of the face and that certain proportional relationships between the components of the facial height remained constant and within a range of deviation. While our findings do not establish an absolutely accurate method of positioning the mandible in edentulous patients or in patients where a closed-bite relationship exists, they do point toward the existence of definite proportional relationships between the components of the facial height and the establishment of a range of measurement within which the chin point or gnathion must fall if the mandible is to be placed in its correct position. It is our hope that further work will lead to direct clinical application of these findings to the various phases of dentistry.

The degree of attrition showed little or no effect upon the ANS-GN component of the centric facial height as is shown graphically in Fig. 6. The centric facial height did not decrease as the degree of attrition increased. This leads one to believe that the position of the mandible is dependent upon the musculature and not the occlusion of the teeth. The teeth evidently erupt into occlusion and into the intermaxillary space maintained by the musculature. The position of the mandible in any given individual remains constant by means of the balance afforded by the musculature and the teeth erupt throughout life apace with the amount of attrition.

Our findings also show that the various proportions of the centric facial height do not vary regardless of the race origin. Where the racial groups were sufficiently large, the means of each racial group were practically the same as is here shown in Tables I and III.

SUMMARY AND CONCLUSIONS

Three hundred and twenty-six adult human skulls, of which 262 were of known origin, were measured to determine the total face height from nasion to gnathion, which was found to average 115.2 mm. Measurements showed ANS-GN to average 65.0 mm. with a mean of 56.49 per cent of total face height. The standard deviation was 2.14.

The relative proportions of face height showed no abnormal variations from the mean, regardless of racial origin of the skull.

The attrition of the teeth did not materially affect the proportions of facial height nor perceptibly change the ANS-GN distance.

The cephalometric roentgenographic results of Brodie were confirmed by anthropologic methods.

There are indications that further work will lead to direct clinical applications of the facts discussed in the construction of prosthetic appliances.

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MECHANICAL ORTHODONTICS, A HALFWAY MEASURE

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TODAY I wish to stress certain essential phases of orthodontics, namely those which depend upon the understanding and appreciation of the biologic. From the earliest days of my association with orthodontics it has appeared obvious that immediate need has called for the development and use of various mechanical appliances for the movement of teeth into alignment, together with mandibular adjustment. This need has seemed so urgent that the orthodontist has employed mechanical methods of many and varied kinds.

Thus the long view has become obscured, and while we have had a number among us who have been exploring the biologic field, the beneficent results of their work have been slow in appearing, and many have been tardy in their appreciation of the advantages to be gained by attending more particularly to the biologic principles necessary to a better understanding of orthodontic problems. It is to be feared that, unless we in our future educational efforts begin at the beginning to emphasize the basic and correlate it with our clinical teaching, we shall continue to side-step the fundamental and important.

A number of years ago there appeared before an orthodontic gathering two essayists. One read an excellent paper on a new and improved mechanical device for the correction of malocclusion. The essayist had much to show for his mechanical effort, and the audience was duly impressed with the ease and speed of the results obtained. It was altogether a fine exhibition of what could be expected by the employment of these particular methods. The other essayist, a famous anatomist, gave an excellent and well-illustrated lecture on the physiologic anatomy of the face and neck, stressing the dental apparatus and the muscles of mastication. Later each of these essayists occupied space in the clinic section. The essayist who devoted his time to the mechanical consideration had numerous models for clinical teaching. The anatomist had spread before him many carefully prepared anatomical specimens. I entered the clinic room a short time after the clinics had started and noticed a great unevenness in the distribution of the members of the Society. Clustered about the table where mechanical orthodontics was being taught the interested listeners stood two or three deep completely surrounding the clinician. At the table directly across the room sat the famous anatomist with his wonderful specimens with not a single listener—not an individual with interest enough to inquire into the fundamental basic needs of the profession. This picture remained in my memory as a rather sad commentary on the basic interest which our profession as a whole actually takes. That I may be thoroughly understood, let me make it clear that I believe and know that a refined type of mechanics is of prime importance in the correction of malocclusion. All of us must resort to the use of mechanical principles and encourage their proper understanding and their legitimate use. But what I wish to emphasize is the fact that the proper understanding of the

Read before the New York Society of Orthodontists, New York City, Nov. 10, 1942.

biochemical and biomechanical nature of our work is of greatest importance, because only by pursuing such basic inquiry can we hope ultimately to solve our greatest problems. Therefore, I wish to stress the idea expressed in the title of this paper that mechanical orthodontics is but a halfway measure.

One may study anatomy until he is conversant with every structure in the human organism, but unless he is able to envisage functional responses to stimuli he is often at a loss when attempting to make the practical application needed for the relief of deformity.

It is, therefore, important that every orthodontist in his approach to practical application retain, as far as possible, the ability to see with the mind's eye the tissue reactions that follow nervous impulses. This is valuable not alone in guiding muscle groups into proper functional performance, but is equally valuable when confronted with the correction of habit patterns. As we view structures in inert form in the dissecting room, are we able to endow them again with life by our visual faculties recalling our study of physiology, or are they to remain forever dead so that we remember them only as inert forms? Remembering them as inert forms we cannot effectually employ our knowledge of anatomy and physiology. Therefore, these muscle bundles must remain alive in our minds in order that we may retain the concept of living orthodontic appliances as we study the patient whose muscular function is faulty.

In our effort to better understand biologic principles we should be on the alert to use our newly gained knowledge in our practical efforts for the individual, and avoid lapsing hopelessly into a position where our mechanical treatment produces pathologic changes by the employment of improperly applied mechanics. We have not as yet been able to attain fully this desirable ability, but because we have not yet attained it gives us no reason to doubt that eventually our clinical methods will be so improved that changes in form, requiring the movement of the dental organs, will more nearly approach biologic requirements.

I recall another instance which occurred a few years ago in which an orthopedic surgeon* called attention to the idea of considering the mouth and its parts as a joint consisting of three occluding surfaces, two of them similar in many respects to other synovial joints, but less limited in action, and articulating with the bony skeleton; the third consisting of interdigitated enamel surfaces. Now, if we visualize a normal, or a typical joint of this kind, and, at the same time, remember its varied and numerous movements as it functions in speaking and in the act of mastication, we become conscious of the very great importance that must be attached to the articulating enamel surfaces; and also we will be particularly impressed with the functioning of the different groups of muscles which must perform many varied and complex movements. And as orthopedists we become muscle conscious, thinking always in terms of muscular action with balances and stresses of so many and various kinds. Visualize again this human masticatory apparatus, but this time, instead of the normal efficient masticatory joint, picture a rather severe case of disharmony in the relations existing between those enamel surfaces which form one of the three points of contact. Adjusting interferences is a mechanical matter to a certain degree—to the degree that any orthopedic appliance functions in assisting the deformed parts back to

*Dr. Henry Milch, Columbia University.

normal relationship, but we also should give more than casual attention to those muscular engines which are really in control of the functional position, and are responsible to a degree for the form which the hard but more fluid parts, namely the investing bony material, assume. It might be profitable, at this point, to hear a quotation from a treatise on orthopedics and try to discover a parallel which may prove helpful to us. Orthopedists agree that the treatment of club-feet should be undertaken during the early weeks of a child's life, and that delay of several months is simple neglect. We are told that "Early treatment consists of frequent gentle manual correction and the employment of some means of retaining the foot in an improved position. Frequently this improved position will become in a few weeks a fully corrected or even an overcorrected position. The degree of the deformity and the resistance met in overcoming it, should determine the method to be followed. Cases which, from the beginning, show a marked improvement from manipulation and simple bandaging may be thus treated as long as improvement continues. We become aware at once when we watch the functioning of this defective joint that the muscle groups are not functioning as in the normal picture, and we also observe that the other two joints, the synovial protected points of contact, are, perhaps, not working in a uniform and harmonious manner. If we happen to be of an inquiring mind, we may ask ourselves certain questions such as come naturally to the trained orthopedist when he considers deformities in other parts of the body; and we may, perhaps, conclude that genetic influences in some instances might be significant. We also conclude, just as the orthopedist does, that certain maldevelopments come about as a result of an enfeebled musculature, possibly due to malnourishment of the cellular elements of nerve and muscle as a result of faulty diet during the growth of the child from infancy. Having thought about the matter in this way we naturally adopt the more efficient methods for the correction of whatever anomaly we may be considering, and try as we may we will be unable, as orthopedists, to forget that the muscles must be given a particular amount of attention, and every effort made to attain, as quickly as possible, tonus and balance in these very muscle groups that are not functioning in a smooth and harmonious manner.

In some of the maloclusions that we have been visualizing, we notice that the articular enamel surfaces are not at all in their right relationship. The malrelation may be such as to render it impossible for the individual to function except with the mandible in a recessive position. Further study very likely will reveal that there are various interferences which the muscular system has been unable to overcome, in its feeble endeavor to function with the parts in normal relationship, and we conclude that during the growth period of the individual the muscles have been too weak in their functional activity to overcome the interferences of these enamel organs during the developmental period. It then becomes plain that interferences must be removed in order to allow the muscles to function in their proper manner, and when these interferences are removed we may then strengthen the various muscular groups, and thus assist in establishing a normal oral joint where the enamel surfaces are articulating properly, and all the living machinery is able to function in a smooth and easy manner. As soon, however, as improvement becomes arrested, greater care must

be given to the retention apparatus. The foot must be held at all times in the best possible position; only in this way can progress be made. If the apparatus used is a removable one and if massage and movements at the joints are practiced, care must be exercised to prevent the assuming of the deformed position, even for a moment, while the apparatus is off." This quotation from the *Diseases and Deformities of the Foot*, by Dr. John J. Nutt sounds almost identical with the instruction that one who is interested in orthodontics, from the orthopedic standpoint, would naturally give when speaking of early treatment in cases of distoversion.

The orthodontist of the future will be more definitely concerned with the facts of growth and development and also with a study of nutrition which is fundamental to both. Growth and development are so closely related that in speaking of one we must, at the same time, be thinking of the other because of their interrelation.

Biologists and embryologists have made it clear that at conception a process of cell multiplication at once becomes manifest, and coincidentally a process of cell diversification, of differentiation, under normal circumstances continues in its complex and mysterious course until the physical structure of a new individual has been completed.

We may consider then that growth consists of cell multiplication—that is the augmentation of the body which takes place between its beginning to adult age by addition to the number of its cellular elements. Development consists in differentiation of the growing cells into the various structural units which go to make up this new individual. It consists of a sequence of organic changes by which the fertilized ovum becomes the mature organism. Through the various stages of development from the beginning, this new individual progresses until one functional structure after another is developed. A certain tendency directs the drift, or the trend of development of an organism, along a line parallel with that of a series of forms ancestral to it. The moment growth and development in the embryo take place there is established, by the law of heredity, certain definite and irrevocable patterns—the color of the hair and the eyes, and the general physical structure which includes the face and the jaws are in a measure predetermined by these mysterious influences. That is, the growing individual tends to resemble the ancestral series to which he belongs. So that when he finally takes his place he is endowed with certain physical and mental characteristics, and, in addition to these predetermined tendencies, he is forced to cope with a new environment where he meets influences which have a significant bearing upon his future growth and development. It has been said recently by biologists that heredity determines the limits to which the organism may develop, while the environment determines how far upon this hereditary journey he will be able to proceed. All kinds of environmental handicaps are placed in the way unless he is a most favored individual. Then perhaps his environment may place few if any impediments upon his hereditary rights. For most of us handicaps of every conceivable nature may be placed in the way of full development—handicaps of an internal nature as well as those of an external nature. Our internal handicaps for the most part result from imbalance in glandular function, handicapping our metabolic function in converting essential

food materials into living protoplasm. And so when we have under consideration the dental care and dentofacial form we are forced to think and measure our remedial activities in relation to them. Unfortunately for the individual as well as for ourselves this combination of heredity and environment often places before us problems that are at present unsolvable.

All developmental processes working in the individual are governed by the purposeful laws of physics and chemistry. This should be remembered when we consider the living organism; nor can we escape the conviction that we are studying and observing living machinery. Machinery that for its very existence, and for the continuance of its function, must depend upon nutriment, and that nutriment in order to attain its final purpose must be considered in correlation with numerous biochemical processes which are continuously in operation within the organism. Any slight imbalance has its far-reaching effect, and ofttimes interferes with the architectural development of those parts of the human body with which we are concerned.

Up to this moment few interested in orthodontics have included in their diagnosis that all-important and fundamental biochemical diagnosis. In the future I believe that ever-increasing attention will be given to the scientific search for deficiency manifestations, with an increasingly successful attempt at their correction, and with the ultimate goal that, through biochemistry, mechanical and functional treatment may become more uniformly successful, and severe malocclusions should be met with less frequently. It is the understanding of the chemistry of living tissues that now holds for us the greatest promise.

Therefore, it is necessary that we give proper consideration to those important nutrient functions. For until a proper understanding of their influence in growth and development is attained, it will be impossible for us ever to reach that wished-for goal where our services to humanity shall consist in a prevention of disease and deformity. Along with these important and fundamental considerations there is one which we can immediately apply to the alleviation of certain forms of dentofacial anomalies. I refer to function, meaning in this instance muscular function.

We know that during the early development of the individual there are certain tissues set aside to assist in the continuance of life, and these are known as functional tissues. Tissues which require the activity of muscle in order that development may reach its final architectural form. Without muscular activity no human being can survive birth, for it is only through the activity of muscles with their instinctive yearnings that the infant is able to supply himself with nutrition for further growth and development. We realize that during the growth of the organism functional tissues are developed to a point where the individual is provided with tissues satisfactorily arranged for the maintenance of life. If at birth these organs, or parts, fail to function, the organism, of course, does not survive. It is in accord with the inherent vitality of the individual that the various functional tissues continue their development. If the performance of function chances to be one of feeble nature the tissues involved may not develop sufficiently to be able to overcome environmental interferences. We can consider function, then, as the normal purposive motor achievement of organs or tissues designed to further growth and development in the organism,

and the maintenance of organic health in maturity. Functional activity may be feeble, moderate, or strong and adequate, and the resulting development of form will be influenced by whichever of these three degrees becomes habitual for the individual.

While for the dentofacial orthopedist applied mechanical stresses are necessary as aids in the correction of maldeveloped tissues, their place must be understood when taking the long view as a more or less transient means of service. We must look ever to the solution of those secrets of life's processes which, when more fully comprehended, may at least, minimize the use of applied mechanics by the establishment of a surer method of tissue nourishment through the influence of a more nearly perfect environment, both internal and external.

To summarize briefly the underlying reasons for abnormal growth and development of the dental parts, we think first of hereditary influences. Second of nutritional disturbances, sometimes as a result of faulty biochemical reactions. Third of the feeble function of the mechanical parts which often resolves itself into actual dysfunction; and last of malfunction when the machine becomes slightly maladjusted and, by the continuation of functional activity in the slightly maladjusted organ, the affected parts tend toward further maldevelopment, more especially where faulty bony structure is encountered. Demineralized bone is inadequate bone. According to Todd there is no efficient response to the orthodontist's efforts.

Whereas, formerly, the orthodontist had but one weapon, namely mechanics, at his command in the correction of dentofacial maldevelopments, I have tried to point out that he now has three. For by adding function together with nutrition he is able to obtain an alliance of forces between applied mechanics, improved cellular responses and muscular function with its attending form-directing powers. The psychologic approach to orthodontic problems might be considered a fourth vital adjunct to treatment; but for important reasons is not being considered in this article. Functional exercises are purposeful—that is they are devised carefully in accordance with good orthopedics—their timing as to period and frequency is important. They should not be attempted without some understanding of the physical requirements of the individual.

There is truth in the idea that the "living machine" is in a measure able to correct itself by the intelligent application of recognized inherent forces. I have attempted to point to the fact that it is necessary for us, as orthodontists, to accept the basic point of view, and further strengthen our efforts by attaining a full realization of fundamental processes of growth and development in the individual organism. I hope I have made it clear that it is not enough for us to consider the idea of applied mechanics, but for the sake of future progress our interest should be concentrated on a surer knowledge of the individual and the obscure characteristics of living tissue in its reactions to various natural and artificial stimuli.

I realize fully that I have dealt in generalities, but it is necessary for us at times to make such general surveys in order to come to a realization of where the proper emphasis should be placed to build a well-rounded and integrated volume of knowledge.

60 CHARLESGATE WEST.

REPORT OF THE COMMITTEE ON EDUCATION

The biggest problem in orthodontic education is that of undergraduate instruction. Graduate instruction seems fairly well standardized, at least to the extent that all graduate courses are well-organized courses and ample to give the fundamental training necessary for a specialist in orthodontics.

The laboratory evil which confronts the profession today may or may not be the result of present-day undergraduate education. The study made by Charles R. Baker proves that the only requirement for diagnosis, treatment planning, and an appliance to do the job is a set of plaster casts of a case of malocclusion. Whether more education in orthodontics for the undergraduate student would stop this vicious practice is an open question. A little knowledge is a dangerous thing, but can enough knowledge of orthodontics be taught in the dental school curriculum to give the general practitioner in dentistry a true appraisal of his ability and training. On the other hand, can enough orthodontic training be given to train a student to select and treat simple cases of malocclusion adequately? What are the responsibilities of the profession to the communities where an orthodontist is not available? How much orthodontic training should a dentist have who holds a state license which permits him to practice orthodontics? Does the responsibility of the educator cease when enough orthodontics has been given to enable the student to pass the state board examination in orthodontics? Are the state board examinations in orthodontics ample to determine if a dentist should be given license to practice orthodontics? Where, in the full curricula of the dental schools, can additional hours, if desired, be found for additional orthodontic instruction? These are the problems confronting the educators.

Your committee realized the importance of this problem and with these questions in mind made an attempt to survey the undergraduate orthodontic education in the dental schools of the United States and Canada. The logical first step seemed to be a general appraisal of undergraduate training as it exists today. Questionnaires were sent to forty-four dental schools and thirty-one were returned. This is a return of 70 per cent which shows the fine cooperative spirit of the professors of orthodontics in our schools.

There is quite a variation in the returned questionnaires. Different schools regard the hours of work from different viewpoints and to reduce all to a common denominator it was necessary to make the appraisal on a clock hour basis.

The accompanying graph represents the orthodontic training of thirty-one schools. The schools numbered 3½, 13½, and 24½ are three schools whose questionnaires arrived after the compilation of the data was in an advanced stage. Each column represents the total clock hours devoted to orthodontics in a particular school and those hours are divided into:

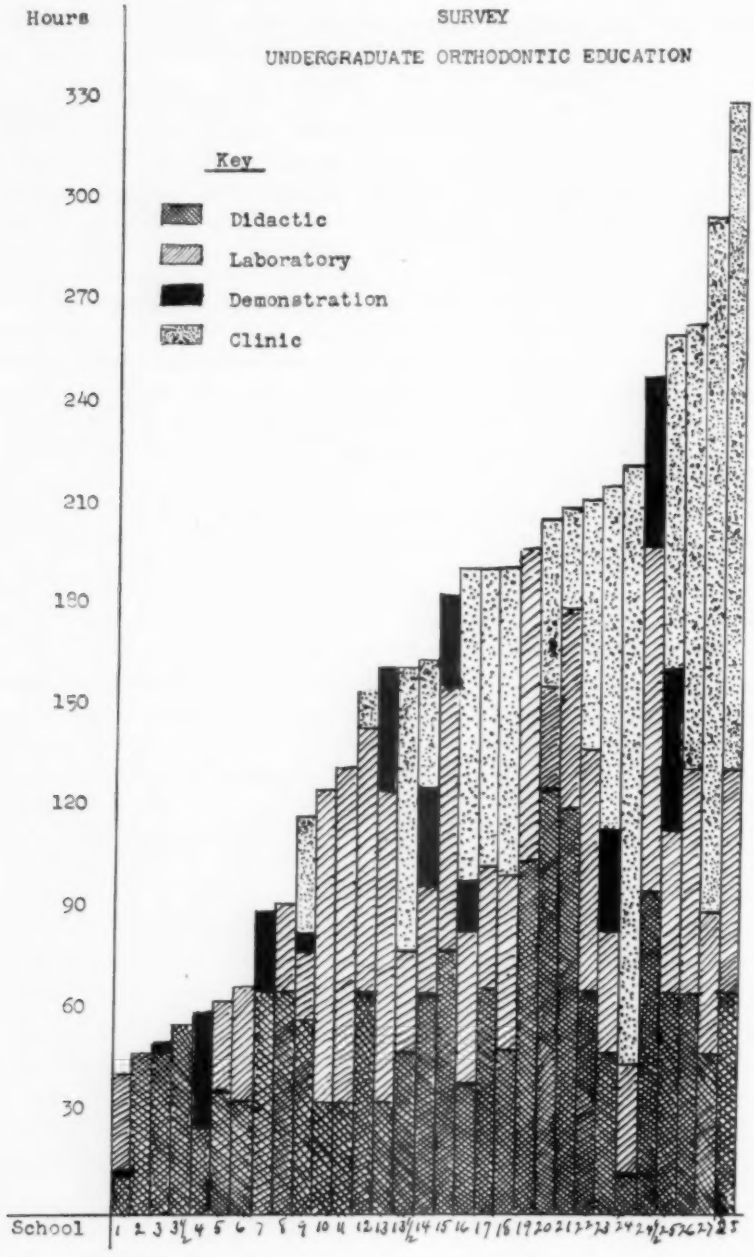
1. Hours of didactic work shown by cross hatching.
2. Hours of laboratory classes shown by diagonal lines.
3. Hours of demonstration shown by solid black.
4. Hours of clinical training shown by dots.

A summary of the survey reveals a number of interesting facts:

1. All of the schools give a didactic course.
2. One school gives only a didactic course.
3. Three schools give all four sorts of courses, namely didactic, laboratory, denomstration and clinical.
4. Twelve schools give didactic, laboratory, and clinical work.
5. Three schools give didactic, laboratory, and demonstration work, but no clinical work.
6. Seven schools give only didactic and laboratory work.
7. Four schools give only didactic and demonstration work.

8. Thirty-one schools give didactic work.
9. Twenty-six schools give laboratory work.
10. Ten schools give demonstration work.
11. Sixteen schools give clinical work.
12. Eight schools give elective clinical work.

The wide variation in the hours, types, and different combinations of courses in the different schools is obvious in the survey. The influence of the state board examinations on the courses is evident. Further efforts to equalize the courses to approach a common standard in undergraduate education seems desirable.



This study does not answer any of the questions suggested in this report, but it does show the situation as it exists today and may serve as the ground work for further study in this field.

The committee wishes to express its gratitude and appreciation to those men who so unselfishly gave of their time to fill out the questionnaires and make this survey possible.

Respectfully submitted,

LELAND R. JOHNSON, Chairman
THOMAS D. SPEIDEL
GEORGE M. ANDERSON

WHEREAS, the Board of Regents, University of the State of New York, Department of Education, having voted February 21, 1941, that authorizations for proprietary orthodontic schools be extended only to March 1, 1942, unless they establish organic connections with registered and approved universities, and,

WHEREAS, by this action of the Board of Regents, University of the State of New York, recognized the seriousness of lowering educational standards as a menace to public health, and,

WHEREAS, the Board of Regents has reversed its decision effective March 1, 1942, and granted an extension for operation of proprietary schools for a period of three years:

Be It Therefore Resolved, that the American Association of Orthodontists, sitting in official session in the City of New Orleans, Louisiana, week of March 16, 1942, vigorously protests this reversal on the ground that any such training is inadequate to maintain highest professional standards and protection of the public, and,

Be It Further Resolved, that these resolutions be spread upon the minutes and that a copy of said Resolutions be sent to the Board of Regents, University of the State of New York, Department of Education, Albany, N. Y.

Respectfully submitted,
COMMITTEE ON EDUCATION

March 18, 1942

Editorial

Gasoline Rationing and Orthodontic Problems

The editor of the AMERICAN JOURNAL OF ORTHODONTICS AND ORAL SURGERY has received numerous letters from its readers making inquiry as to ruling, if any, by the War Price and Rationing Boards pertaining to gasoline mileage for patients who make periodic visits to orthodontists and who live at remote distances. It appears that in some instances a real hardship on the patient has been created, as well as an important dilemma for the orthodontist. In most of these cases, patients have been in the habit of visiting their orthodontist at periodic intervals from long distances, there being no transportation available other than that of private automobiles. In such event, an important problem is created, and in the event treatment is suddenly discontinued or carelessly handled, complete relapse of the case is the customary end result, and this involves a great hardship for the patient.

In this connection a letter addressed to a patient undergoing orthodontic treatment was sent from the War Price and Rationing Board under date of Dec. 17, 1942, and has this to say:

> Rationing regulations require the Board to encourage and promote ride-sharing arrangements where possible. Therefore, may we suggest that you endeavor to effect a ride-sharing plan whereby the use of one vehicle will meet the needs of both in this matter. Upon consummation of such a plan, we will issue a ration sufficient to provide mileage for one round trip.
>
> However, the regulations permit issuance of special rations only to meet bona fide emergencies; and, in the future, when applying for a ration for this or a similar purpose, you should furnish this Board with evidence of one of the following conditions: (1) that the patient's condition will not permit the use of public transportation facilities, or (2) that public transportation is not available.

It is understood that gasoline is to be allocated for hospitalization and medical treatment. The confusion among orthodontists and local boards seems to arise over the question as to whether or not such a ruling includes orthodontic treatment. The editor of this JOURNAL has been advised by orthodontists from various parts that in some instances a letter directed to the local board of gas rationing, estimating the approximate intervals of appointments required for individual patients, has been sufficient evidence for the patient to secure supplementary gasoline for the necessary visits to the office, after the letter has been exhibited to the local gas rationing board.

It has been learned, as well, that orthodontists who maintain a branch office in some other locality have been able to secure supplementary gasoline from their local gas rationing boards that enables them to make periodic visits to their offices at intervals of the same duration as in the past.

During these times of dislocation and readjustment in practice, the JOURNAL will be glad to cooperate in this problem and publish the opinions and experiences of its readers in meeting these new conditions in order that information may be widely disseminated among its readers. It is to be hoped the cooperation of readers in solving the problem will be of some benefit to those who have not been fortunate in solving the problem with their local boards.

H. C. P.

Just previous to the time of going to press, the memorandum that appears below was sent out by the Southwestern Society of Orthodontists. Inasmuch as it is thought the information contained is of general interest the bulletin is herewith printed. Editor.

MEMORANDUM

At a meeting of the officers of the Southwestern Society of Orthodontists, held in Oklahoma City, Okla., on Jan. 10, 1943, to make plans for the 1943 meeting and consider other business problems, the officers directed that the following information be sent the members with the idea that it would probably be of some benefit.

OFFICE OF PRICE ADMINISTRATION
WASHINGTON, D. C.

In reply refer to: 735:COR
RR:5A

Dr. T. W. Sorrels
Chairman, Public Relations Committee
Southwestern Society of Orthodontists
1003 Medical Arts Building
Oklahoma City, Oklahoma

Dear Dr. Sorrels:

We thank you for your recent communication.

The Mileage Rationing Regulations provide Special rations in case those already issued are not reasonably adequate for obtaining necessary medical attention or to procure necessary food and supplies. In order to be eligible for Special rations to accomplish those purposes, the applicant must satisfy his local War Price and Rationing Board of his need, of the insufficiency of any rations he already has and of the unavailability of others means of transportation.

The determination of facts establishing the eligibility of an applicant for any type of rations is to be made by the local War Price and Rationing Board. The Office of Price Administration in Washington does not assume jurisdiction to make those determinations in individual cases.

We hope this information will be helpful to you.

Very truly yours,

JOHN R. RICHARDS, Chief
Gasoline Rationing Branch

It is suggested that the following forms be used in certifying individuals who find it necessary to avail themselves of special allowances of gasoline

through their local rationing boards to meet their orthodontic treatment requirements.

FORM 1.—Singular appointments
GASOLINE RATIONING BOARD:

This is to certify that_____has an appointment in my, or our, offices on_____for dental orthopedic treatment.

Signed:_____

FORM 2.—Visits during a period of time
GASOLINE RATIONING BOARD:

This is to certify that_____will be required to make about_____trips to my, or our offices between_____ and_____for dental orthopedic treatment.

Signed:_____

Some of the boards are using the No. 2 plan to simplify matters.

Respectfully submitted,

PUBLIC RELATIONS AND
MILITARY AFFAIRS COMMITTEE
T. W. SORRELS, Chairman
CURTIS WILLIAMS, Secretary

In Memoriam

Leslie P. Abbe

(1879-1942)

Leslie Parker Abbe of 20 Sunnyreach Drive, West Hartford, Conn., a prominent Hartford dentist for many years, died Monday, Sept. 7, at his home. He was president of the Hartford Dental Society from 1917 to 1918, and chairman of the finance committee of the state dental society for three years.

Born Aug. 21, 1879, in Windsor Locks, Conn., Dr. Abbe received his schooling in dentistry at Philadelphia Dental College, graduating in 1907. He engaged in general practice and orthodontics until 1926, when he gave up general practice to specialize in orthodontics. He was a member of the American Dental Association, the New England Dental Association, the New York Society of Orthodontists and the American Association of Orthodontists.

Dr. Abbe retired in 1935 but was honored by his associates in 1939 when the state dental association celebrated its seventy-fifth anniversary and dedicated its anniversary booklet to him.

Other organizations in which Dr. Abbe held membership were St. Johns Lodge, AF & AM, Wolcott Council, Pythagoras Chapter, Washington Commandery and Sphinx Temple Shrine. He was a thirty-second degree Mason and a member of St. Andrews' Episcopal Church.

He leaves his wife, Esther Hocker Abbe; two daughters, Mrs. Louis S. Carney and Miss Miriam O. Abbe, both of West Hartford; a grandson, Richard Parker Carney; two brothers, Earl C. Abbe, of Longmeadow, Mass., and Russell Erwin Abbe, of Elmwood, Conn., and three sisters, Mrs. Robert Dickson of West Orange, N. J., Mrs. Harry Marsh of Scranton, Pa., and Miss Irene Abbe of Elmwood, Conn.

Reprinted from the *Journal of the American Dental Association* **30**: 147, 1943.

Department of Orthodontic Abstracts and Reviews

Edited by

DR. J. A. SALZMANN, NEW YORK CITY

All communications concerning further information about abstracted material and the acceptance of articles or books for consideration in this department should be addressed to Dr. J. A. Salzmann, 654 Madison Avenue, New York City.

Dental Studies of Triplets. I. Measurements of Arch Width and Length: By J. T. Cohen, C. P. Oliver, and S. Bernick, *J. Dent. Res.* **21**: 233-239, April, 1942.

Twins or triplets of monovular origin developed from a single fertilized ovum and have identical hereditary factors; therefore, differences between two individuals of the set may be considered due to environmental influences. Non-identical individuals of a set develop from separate ova and have hereditary factors no more alike than any set of siblings; but they have developed under similar conditions. The differences and similarities observed in a fraternal set can be used in a comparative manner in studies of identical individuals.

The subjects for this study were selected from a group of children who were studied at the institute of Child Welfare of the University of Minnesota. Impressions were taken of the dental arches of 9 sets of the triplets whose ages ranged from 4 to 16 years. Study casts were poured in plaster and measured.

The dental measurements representing the arch size for 9 sets of triplets and 3 sets of nonrelated individuals were determined. The degree of concordance based upon the "corrected identical measurements" was determined for each combination of the members of a set.

From these studies it seems that likeness in twins is due not only to a common heredity, but also to like age and sex. Any two members of the control set are as similar in dental measurements as any two related members of the triplet set other than the identical pair.

Dental measurements as studied here cannot be used alone to determine monovulars in twins and triplets. Identical individuals may be relatively similar in their measurements; but some twins classified as identical by other criteria vary considerably in their dental measurements. Fraternal twins in these studies show as much variation as do nonrelated pairs of like age and sex. Mutilation and exfoliation of the teeth leading to temporary conditions occur at different times in the members of a set and cause variations in the dental measurements (Cohen, Oliver and Bernick, 1942). A single study at one time in the life of the individuals, may, because of temporary conditions and disease conditions, lead to wrong conclusions. These data indicate that caution is needed in the use of dental characteristics for the determination of monovularity.

Dental Studies of Triplets. II: By J. T. Cohen, C. P. Oliver, and S. Bernick, *J. Dent. Res.* **21**: 413-420, August, 1942.

The purpose of this report is to show the degree of similarity found in the arch form and pattern of identical and nonidentical individuals in sets of triplets. Cellophane was stretched over a rack and placed over the incisoocclusal surfaces of the dental study casts tracings were then made of the incisal and occlusal margins of the upper and lower arches. The arches of a set of triplets were then superimposed for comparative study.

Certain extrinsic factors may so alter the arches that one finds it difficult to interpret the arch tracings of twins. Members of identical triplet sets should on the basis of heredity have arches of the same width and length. Due to the extreme carious condition of the permanent molars, and due to the early loss of the deciduous molars, arches were found so deformed at the time of the study that only a faint similarity could be observed in the tracings of the upper and lower arches of two members in a group and the arch tracings of the third member were unlike those of her sisters. The effect of premature loss of the lower left second deciduous molar shows itself upon the dental arches. A collapse of the arches of two boys had occurred to such an extent that the succeeding premolars erupted lingually. As a consequence, the adjacent teeth tipped in a mesial and distal direction and caused a change in the original length and width of the arches. Caries of the first permanent molars in one of the boys, and also the early loss of the deciduous molars in another boy caused changes in the arches which were so great that it was impossible to obtain tracings of the lower arches.

Another factor which can lead to misinterpretation in a study on identical twins is associated with the differences in the eruption time of the permanent teeth, although that effects only a temporary condition and influences the width and length of the arches for a time only.

The arch patterns of identical twins, as shown in this study, were in general more alike than were the arches of nonidentical twins or of nonrelated persons. Variations in arch patterns, however, can be expected in identical twins. Although each twin pair in two triplet sets were found to have almost identical arch patterns, considerable variations were observed in the identical twin pairs of three triplet sets. Some of the differences observed in the arches of identical twins can be explained by mutilations and by differences in the time of eruption of the teeth. In one set, however, no mutilations had occurred at the time of the study; yet the pair of identical twins showed many dissimilarities.

Individuals of like age and sex will often have relatively similar arch patterns regardless of heredity. Both methods used in this study, dental measurements and arch form and pattern, may give misleading information on monoval origin of individuals. Of the two methods, however, the use of arch pattern seems to give a more exact interpretation. In one set the two members with a relatively high degree of concordance in dental measurements had a high degree of variation in arch patterns. The two identical twins of another set had the lowest degree of concordance of dental measurements of any of the

sets studied; yet their arch forms were found to be more similar in shape and size, but varied slightly in pattern.

In the sets studied, the identical twins differed more in their dental measurements than they did in arch patterns. The use of arch patterns will be the more reliable in the determination of monovular origin.

A Valuable Aid in Soldering

Tungsten wire is an ideal aid of soldering, but with war rationing of metals, the question is: Where can you obtain tungsten today?

When your electric bulb burns out, inside the bulb near the socket end, insulated by glass, is a tungsten wire. By breaking the insulated glass away this wire can be obtained.

Using a broach holder as a handle, this wire can be used as a tungsten pencil.

To a prosthodontist the tungsten pencil can be a valuable aid in teasing solder to flow to a definite spot.

The experienced orthodontist knows that this tungsten wire can be used to tease or snap off soldered wire from heated arches.

The melting point of tungsten being 5432 degrees Fahrenheit or 3000 degrees Centigrade, this wire can withstand the average heat used in dental soldering. The higher the wattage of the electric bulb the thicker the tungsten wire will be. The tungsten wire found in a 100-watt bulb will serve your purpose.

Tungsten wire is more resistant to oxidation than a lower fusing metal. Areas or joints to be soldered are less apt to be contaminated when tungsten wire is used to direct the flow of solder.

Herman Rodnick, D.D.S.

Facial Neuralgia Due to Mechanical Abrasion: By Dr. Ciro Durante Avellanal, Condensed from *Tribuna Odontologica,* November, 1941, Argentina.

N. N., a 65-year-old man, showed the following symptoms: Pain in the right side of the head, corresponding to the trigeminal region. The pain was of paroxysmal character with short intermissions and produced tears in the patient and a continuous desire to masticate and rub his face with his hands or handkerchief.

The neuralgia was of 8 months' duration and during that period, all the maxillary teeth as well as the mandibular molars of the affected side had been extracted which provided him with brief periods of relief. A general clinician and a specialist were consulted without success; the therapeutic arsenal had became exhausted.

At first impression we thought this was a case of essential neuralgia (due to an unknown cause) as the clinic data were all negative. There was no trace of syphilis or toxinfectious lesions. Specialists in throat, ear, nose and eyes failed to find any possible cause.

In making the examination we verified the lack of teeth in the maxilla; in the mandible were still present the first and second left molars, the four pre-

molars, both canines, and the four incisors. All of them were firmly implanted and without trace of decay or paradentosis but presented a well-marked abrasion, principally over the premolars and canine of the affected side.

The complete set of x-rays failed to show any impaction or suspicious shadows (the article is accompanied by two intraoral x-rays of the anterior and right premolar region), but we could determine clinically in the right canine and in the first premolar of the same side a great proximity between the pulp and the abrasioned external surface of those teeth; that is to say the pulp did not defend itself against the slow waste of the abrasion and failed to form secondary dentine. We suspected, therefore, that this could be the cause of such a rebel neuralgia.

In proceeding to open the above-mentioned teeth, we verified the proximity of the pulp (which we exposed with hardly any pain to the patient) with the occlusal surface. Although there was no gangrene (we had slight bleeding), sensibility was extremely diminished.

Prior to anesthesia we extracted the pulp in both teeth and left a dressing.

Next day the neuralgia had lessened greatly and after three days disappeared completely. Eight days later we completed the root canal therapy and filled the cavities in the crowns.

Four months have passed and up to date the neuralgia has failed to reappear. Therefore, we have the right to infer that it was caused by a pulpal affection due to mechanical abrasion.

Carlos Giro.

Delay in the Eruption of the Canines in Relation to Hypogenitalism: By Drs. Jose Dueñas and Clodomiro Guridi, Condensed from *El Odontologo*, Buenos Aires, March, 1942.

After a brief consideration of the important role played by the canines in the natural and sexual selection in certain animal species, the authors suggest that this same relation could also exist in the human race although covered and dissimulated by its actual civilization, environment, etc. They point out the fact that the eruption of the canines in the dental arch coincides with puberty (period in which the child will acquire the secondary sexual characteristics, that lead to the adult period).

They continue: "We have observed that children whose canines do not erupt on time, not until the thirteenth year and principally those erupting after that period, having their canines in ectopic position, were generally of weak aspect, physically considered, showing also certain psychologic alteration—timidity, pusillanimity, bashfulness; in other words, their temperament and dynamism were not the same as those of children whose canines erupted normally in size, shape, and time.

"We must stress the fact that our observation is not related to those cases of impaction or delay in eruption due to mechanical or analogous causes, but referred principally to cases in which there did not exist the obstacles above mentioned and showed a retardation in eruption due to lack of eruptive strength."

The authors obtained their material principally among children examined at the Municipal Institute of Orthodontics and Children's Dentistry, Buenos

Aires, where they have observed with certain frequency the coexistence of the dental alterations mentioned above, with genital disturbances. Retention of the canines was observed, in children showing marked signs of hypogenitalism. Several of these cases had a history of testicular ectopia uni- or bilateral. In others these anomalies still persisted, showing lack of secondary sexual characters (absence of hair at the pubis and axilla) together with obesity and abnormal distribution of adiposity predominant at the pelvic curvature, mammae, arms, thighs, etc. (genito-adipose dystrophies).

The authors declare the actual lack of evidence upon any possible action of the sexual hormones acting in the eruption of the canines and suggest that the timely eruption of those teeth could be considered as a supplementary sexual character in the human species.

Carlos Giro.

Psychologic Care During Infancy and Childhood: By Ruth Morris Bakwin, B.A., M.A., M.D., Assistant Clinical Professor of Pediatrics, New York University College of Medicine; Director of Pediatrics, New York Infirmary for Women and Children; Assistant Pediatrician, Bellevue Hospital, New York City; and Harry Bakwin, B.S., M.D., Associate Professor of Pediatrics, New York University College of Medicine; Associate Pediatrician, Bellevue Hospital, New York City; Consultant, Middletown Hospital, Middletown, New York. Pp. 297, Price $3.50, New York, D. Appleton-Century Company, 1942.

This book should prove to be a useful edition for anyone interested in child welfare. The authors are not psychiatrists but pediatricians, well grounded in psycho-pediatrics. It is simply written for parental understanding, well organized and rings with sound common sense.

The orthodontist and the dentist should be well grounded in child psychology and not rely solely on his innate ability in handling children. The first chapter deals with the meaning of optimal child care, the physical and psychologic development or maturation. Quoting the authors, "Development is innately determined and can be influenced by the environment to only a minor degree. Growth, on the other hand, is strictly a quantitative concept and refers, in the physical sphere, to change in number or size of units and, in the psychologic sphere, to the acquisition of information, skills, and emotional interests. Growth is susceptible to environmental influence." The chapter on treatment, emotions, training, discipline, parental attitudes and antisocial behavior should be of particular interest to a dentist and help him to handle children more effectively.

J. H. Sillman, D.D.S.

A New Method of Treating Unerupted Teeth by Means of Surgery and Orthodontia: By Samuel W. Leslie, M.D., D.D.S., *J. Canadian Dent. A.* **8**: 364-369, 1942.

Since most of the children requiring this service are over the age of 10 to 12 years, a reasonable explanation is given them of the procedure to be followed. They are reassured regarding the pain factor and their cooperation is

asked for. No undue or unnecessary fuss should be made with drapes or coverings and the child should not be blindfolded as this tends to develop a fear of the unknown. The operator should have all the instruments to be used in the operation available and near at hand, but not in sight of the patient, and no time should be lost in following through the carefully planned steps of the operation.

The field is prepared in the usual manner. The choice of anesthetic solution should be 2 per cent novocain with epinephrine and, although infiltration can be used, the block method is preferable.

Using a sharp scalpel the incision is made and a flap laid back along with the mucoperiosteum by means of a periosteal elevator. In many cases the overlying bone can be removed with a sharp chisel or small rongeurs.

To uncover maxillary cuspids which are buried high up in the palate or buccally in the canine fossae, burs and small curettes should be used. As the operation proceeds, the bone debris and crypt tissue should be washed out with warm normal saline solution which is removed by suction. Exposure of the unerupted crown should be as complete as possible on all sides and should extend upward until the neck of the crown is completely exposed. A piece of ligature wire previously sterilized is now made into a loop and this is placed over the neck of the tooth. To prevent this wire from slipping, an instrument shaped like a reversed scaler is used to tuck the wire well over the cingulum lingually and the dento-enamel junction buccally. The loop is then tightened by twisting.

Occasionally an unerupted crown may be found to be firmly wedged against the adjoining tooth, and it would be impossible to make a space for placing this wire without injuring or denuding the adjoining tooth. In these cases the wire can be forced over the obstruction after using a very thin bladed elevator with a little wedging pressure. The wire ends projecting from the wound cavity should be left quite long and can be wound around the crowns of neighboring teeth until the orthodontist is ready to use them, when he will cut them to their required length and attach them to his appliance.

After excising a generous piece of mucoperiosteum, the wound is closed with interrupted catgut or horsehair sutures. The cavity thus formed is packed lightly with some medicated gauze and this is removed on the third day.

In twelve cases there has never been any complaint of afterpain and we have had no trouble with secondary infection. In some cases where the operation was performed buccally there has been some postoperative swelling for forty-eight hours and this was easily controlled by means of ice packs. We have found no need for prescribing sedatives other than the administration of an occasional aspirin tablet.

The only complication worth considering is the question of denuding the roots of adjoining teeth during the uncovering. We feel that occasionally this is beyond the control of the surgeon, inasmuch as this occurs even when an impacted tooth is removed, if the crown has been impacted upon the adjoining tooth. A careful x-ray examination prior to the operation will usually give us sufficient information to warn us of this possible complication.

The possibility of cystic formation, hypercementomas, rarefying osteitis, and cleft of the bony palate should always be kept in mind. Supernumerary

teeth may also be present, as well as definite focal infection from surrounding teeth. These conditions, if present, can be dealt with at the time of operation.

Besides the need for a careful diagnosis before deciding on the advisability of saving or extracting the unerupted tooth, a number of other factors should be taken into consideration. The state of health of the patient is of prime importance. The anatomic relationship of the impacted or unerupted tooth to the maxillary sinus and to other surrounding tissues, as well as the floor of the nose, should be considered. The degree of calcification of the crown and root of the unerupted tooth, and whether caries or root absorption exist will be also apparent from the x-rays and other important elements upon which a decision should rest.

J. A. S.

Enameloid Acrylics in Dentistry. Techniques and Its Applications to Operative and Prosthetic Procedures: By Maurice N. Stern, D.D.S., Associate Visiting Oral Surgeon at Queens General Hospital, New York City. Pp. 141, Price $4.00, Forest Hills, L. I., The Credo Publishing Co., 1942.

This book is an excellent practical manual on the use of acrylic resins in operative procedures. Stern is a pioneer in this field and has spent much time in the practical aspect of this work. Enameloid acrylics have found a place in dentistry. How they may best be employed for this purpose is outlined in this volume.

The use of acrylics in dentistry, as pointed out by Stern, is beset with dangers not because of the difficulties involved but rather because of the ease with which this material can be employed. Because of this fact it is extremely necessary for the dentist who undertakes to employ acrylics to have at hand a practical manual which contains information on the physical makeup of the material, the preparation of teeth for receiving acrylic restorations, and the method of processing them.

This book contains a wealth of illustrations of the highest order which will prove enlightening to the practicing dentist. A useful feature of the book is the section which deals with the prevention of failures. All possible emergencies are listed with reference numbers to the text pages which inform the reader how such emergencies may be met.

Included in the book are instructions for the construction of inlays, jacket crowns, fixed and removable bridges, and partial and full dentures. While it is true that the use of acrylics in dentistry is still in its infancy, Stern is to be congratulated on the presentation of this precise text which will go far toward making the use of this material successful in dental operations. There is no excuse for anyone to flounder in the dark when such a text has been made available.

News and Notes

American Association of Orthodontists Meeting Cancelled

The meeting of the American Association of Orthodontists, which was to have been held in May, 1943, has been cancelled.

MAX E. ERNST, Secretary
American Association of Orthodontists

Pacific Coast Society Meeting Cancelled

The meeting of the Pacific Coast Society of Orthodontists, originally scheduled for February, 1943, has been cancelled.

EARL F. LUSSIER, Secretary-Treasurer

New York Society of Orthodontists

The spring meeting of the New York Society of Orthodontists will be held at the Waldorf-Astoria Hotel, New York City, March 8 and 9, 1943.

Southwestern Society of Orthodontists

The Southwestern Society of Orthodontists will meet March 23, 24, and 25, 1943, at the Mayo Hotel, Tulsa, Okla. The program will consist of the following:

Tuesday, March 23, President E. Forris Woodring will call the meeting to order. The invocation will be given by Dr. Golder Lawrence, Pastor of the First Methodist Church of Tulsa. Dr. G. A. Roelke of Tulsa, President-Elect of the Oklahoma State Dental Society, will deliver the address of welcome and Dr. T. G. Duckworth of San Antonio will present the Service flag. After Dr. Woodring's presidential address, Dr. W. B. Stevenson of Amarillo will speak on "Maxillofacial Fractures," with Dr. Scott P. Bowyer of Tulsa as interrogator. Dr. W. J. Bryan, Jr., Chief of Staff of the Hillcrest Memorial Hospital of Tulsa, will present "General Physical Diagnosis" and Dr. Homer B. Robison of Hutchinson will be the interrogator. Dr. Archie B. Brusse of Denver will speak on "Orthodontic Therapy" with Dr. W. E. Flesher of Oklahoma City as interrogator.

On Wednesday, March 24, General Clinics will be held, with Dr. Brooks Bell of Dallas as chairman. "The War's Effect on Dentistry" will be delivered by Dr. Thomas E. Purcell, Dean of St. Louis University College of Dentistry, St. Louis, with Dr. Francis M. Calmes of Kansas City, Mo., as interrogator. Case reports will be presented by Dr. Walter Lipscomb of Houston, and Dr. Brooks Bell of Dallas, with Dr. Nathan G. Gaston, Monroe, La., and Dr. James C. Williams, Fort Worth, as interrogators, respectively. Dr. Paul G. Spencer, Waco, will speak on "Preventive Orthodontics" and Dr. Harry Allshouse, Jr., Kansas City, Mo., will act as interrogator. Dr. Thomas E. Purcell will also present "Trends of Dental Education" with Dr. Paul G. Spencer as interrogator.

On Thursday, March 25, Business Problems (The Forum) will be discussed, with Dr. Tullie W. Sorrels, Oklahoma City, as interlocutor. The problems to be discussed are:

1. What is the status of the Bills relating to the licensure of dental specialties in Kansas and Missouri? (Commenters—Dr. Leo Shanley of St. Louis and Dr. John Richmond of Kansas City, Kan.)

2. What are the best methods to employ in solving the conflicting problem of school attendance and dental services? (Commenter—Dr. W. Wayne White, Kansas City, Mo.)

3. What business policies should be pursued in making orthodontic fees and collections (regular problems)? (Commenter—Dr. Louis P. Winston, Houston.)

4. How is the war affecting the economic phases of orthodontics and what adjustments seem to be indicated (special problems)? (Commenter—Dr. H. C. Pollock, St. Louis.)

The business meeting will be held following the discussions.

Fourth Mexican Medico-Dental Convention

The Fourth Medico-Dental Convention, organized by the Asociación Mexicana de Ortodoncia, under the patronage of the President of the Mexican Republic, Gen. Manuel Avila Camacho, will be held in Mexico City from March 1 to 6, 1943, at the School of Dentistry, with the cooperation of a selected group of North American physicians, dentists, and orthodontists, headed by Dr. Spencer R. Atkinson.

GUILLERMO S. GAMBOA, Secretary
Madero 34, Mexico, D.F., Mexico

Dr. LeRoy Johnson to Harvard

Dr. A. LeRoy Johnson, orthodontist formerly of New York City and a well-known contributor to orothodontic scientific literature, has recently been called to the new Harvard School of Dental Medicine to carry out general administrative responsibilities.

Dr. Johnson is one of the co-workers who collaborated with the late Dr. Charles B. Stockard in the preparation of the monograph, "The Constitutional Basis of Form and Behavior," as the representative in the field of orthodontics. His most recent paper published in the JOURNAL is "The Constitutional Factor in Skull Form and Dental Occlusion," which appeared in July, 1940.

Dr. Johnson has been named Professor of Clinical Dentistry in the new Harvard school, and also made an executive officer of the Administrative Committee. Other members of the committee are Percy R. Howe, Kurt H. Thoma, and C. Sidney Burwell.

Enrollment in Dental Schools

The curve of enrollment in dental schools for the entire country was upward before war was declared. On Oct. 15, 1941, total enrollment of undergraduate dental students showed an increase of 635 or 8 per cent over 1940. The total enrollment as of Oct. 15, 1942, was 8,848—an increase of 493 or 6 per cent over 1941.

Under all circumstances of the emergency, this is an excellent showing. The beginning classes under the accelerated plan numbered 2,701 for all schools. If this enrollment of each new class is maintained for the duration, the needs of the Armed Forces will be promptly met and the number of dentists available to serve the civilian population will not fall to a dangerously low level. It is important, however, that there be no dimunition in the number of students to be deferred for preliminary and professional training in dentistry.

WPB Appeal for Burs

The War Production Board has been requested to assist in the appeal made by the Office of the Surgeon General of the War Department to all dentists, clinics, and colleges to obtain all burs in original packages in sizes listed which are in excess of six months' absolute need. This is occasioned by the demands of the Armed Forces of the United States. It is urgently recommended that arrangements be made to return burs available to dental supply houses.

It is believed that this method of approach is far more desirable than to obtain a mandatory freeze order which may be more drastic in the time limitation set forth above.

It is recommended that arrangements be made for a centralized pick-up and that the return of burs be so scheduled as to be reportable to the Commanding Officer, New York Medical Department Procurement District, 461 Eighth Ave., New York, N. Y. In order to save the dealer any original loss in the transaction it is understood that the Government will pay the actual cost to the dentist, clinic, or college, plus actual transportation cost.

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AMERICAN DENTAL ASSOCIATION
WAR SERVICE COMMITTEE
Room 311, #1726 Eye Street, N. W., Washington, D. C.
2 January, 1943

TO: State Military Affairs Committees,
Procurement and Assignment Committees, et al.

The War Service Committee is pleased to transmit herewith National Selective Service System Occupational Bulletin No. 44, dated Dec. 23, 1942, in which it will be noted that the War Manpower Commission has certified that Health and Welfare Services are activities essential to the war effort, including therein the offices of dentists and dental laboratories, and under "Critical Occupation," the dentist, dental hygienist, and dental technician. This information in the hands of local Selective Service boards should help materially the chairmen of Procurement and Assignment and State Military Affairs Committees in meritorious cases. The Committee feels that the War Manpower Commission and Selective Service should be again congratulated for their foresight in endeavoring to preserve the critical manpower of the Nation with special reference to the particular classes mentioned in this Bulletin.

Sincerely,
C. WILLARD CAMALIER, Chairman

"*Occupational Bulletin No. 44*
Effective: Immediately
Subject: Health and Welfare Services

1. The War Manpower Commission has certified that health and welfare services are an activity essential to the support of the war effort.

2. This bulletin covers the following essential activities which are considered as included within the list attached to Local Board Release No. 115, as amended:

(a) *Health and welfare services:* Offices of physicians, surgeons, dentists, oculists, osteopaths, mortuary services, podiatrists, and veterinarians; *medical and dental laboratories;* hospitals, nursing services; institutional care; auxiliary civilian welfare services to the Armed Forces; welfare services to war workers and their families.

3. The following list of occupations in health and welfare services are occupations requiring a reasonable degree of training, qualification, or skill to perform the duties involved. It is the purpose of this list to set forth the important occupations in health and welfare services which must be filled by persons capable of performing the duties involved, in order that the activity may be maintained efficiently. This list is confined to those occupations which require six months or more of training and preparation.

4. In classifying registrants employed in these activities, consideration should be given to the following:

(a) The training, qualification, or skill required for the proper discharge of the duties involved in his occupation;

(b) the training, qualification, or skill of the registrant to engage in his occupation; and

(c) the availability of persons with his qualifications or skill, or who can be trained to his qualification, to replace the registrant and the time in which such replacement can be made.

/s/ LEWIS B. HERSHEY
Director

CRITICAL OCCUPATIONS

Health and Welfare Services

Anesthetist
Bacteriologist
Biologist
Chemist
Dental Hygienist
Dental Technician (All around)
(This title covers those workers who are engaged in all of the tasks required in the making of either plaster models, dental fittings and full and partial dentures, or bridges. It does not include workers who perform in only one or several of the tasks required in each phase such as trimming edges or plaster models, soldering of crown seams, cementing of porcelain jackets or polishing of parts, etc.)
Dentist
Dietitian, Institutional
Embalmer
(Included under this title are only those licensed persons who are qualified to perform embalming services in conformity with state laws, and who are engaged full time in such employment.)
Field Director
(Auxiliary civilian welfare service to the Armed Forces in continental U.S.A. and abroad. Included under this title are those persons who are certified by the armed services as actively engaged in a supervisory, or technical capacity in civilian welfare work to Armed Forces stationed at military or naval centers in the continental U.S.A. and abroad, or who are actively serving with task forces. Depending on their assignment, they may specialize in counseling servicemen regarding personal and family problems, supervise housing, feeding, recreation and general morale work of servicemen on leave in foreign cities.)
Food Analyst
Immunologist
Intern, Medical
Medical Technician
Nurse
Nutritionist, Institutional
Occupational Therapist, Supervising
Oculist
Optical Inspector
Optical Mechanic (All around)
(Included under this title are workers who engage in all of the tasks required in either optical lens surface grinding or bench work, as required in the compounding of eyeglasses and spectacles according to or for prescriptions. It does not include workers who specialize in only one or several of the tasks included in each of these 2 phases, such as blocking, fining, drilling, or mounting.)
Optometrist
Osteopath
Oxygen-Therapy-Equipment Technician
Parasitologist
Pathologist
Pharmacist
(This title includes only those persons who are licensed to practice pharmacy in conformance with state laws; who are actively engaged in the practice of pharmacy, and whose professional services are available on a full-time basis. It does not include pharmacists when engaged in other than the practice of pharmacy, or other persons who may be employed in a pharmacy or drug store.)
Physician
Podiatrist
Surgeon
Veterinarian, Livestock
X-Ray Technician

Place of Residence Affects Tooth Decay

The best teeth in the nation, at least among children and men of military age, are found in Arkansas and the South and Southwest generally, Dr. Bion R. East, dentist and public health professor of the College of Physicians and Surgeons, Columbia University, stated at the meeting of the American Public Health Association in St. Louis.

The worst teeth are found in New England, Dr. East reported after studying draft records of the 1918 Army, the 1863-1864 Federal Army, and the preliminary figures from the 1940-1942 draft. The 1918 records showed that when measured by the Army's standards, the teeth of the men of Vermont were 35 times poorer than those of Arkansas.

Missouri rated high in excellence of its men's teeth in 1918. Study of draft rejections then showed that only three states in the nation had lower rejection rates for dental defects than did Missouri.

"The probability that the reported differences were not due to chance," Dr. East stated, "is strengthened by similar results obtained in a survey made of U. S. Navy recruits of 1934. In that survey the New England men, when compared with those of other sections of the country, also had the most evidence of past and present tooth decay. Arkansas, the state with the lowest rejection rate for dental defects in the draft of 1918, had the best record in this respect in the Navy's survey of 1934.

"Preliminary reports from the drafts of 1940-42 suggest that marked variations in the magnitude of the rejection rates for dental defects will again prevail among the different states. The indications are that New England will again lead the rest of the country in the percentage of men rejected for military service for poor teeth and that the men of the southern and southwestern states will again have the low rates. Similar trends in the distribution of tooth decay were found in dental surveys of children residing in different states."

Reasons for the relation between tooth decay and place of residence were not given by Dr. East, but his findings coincide with earlier findings of United States Public Health Service scientists on the relation of fluorine in the drinking water, mottled enamel and tooth decay. Fluorine in drinking water and the mottled enamel it causes are both prevalent in the southwest, but the mottled enamel teeth rarely decay. New England water supplies, so far as they have been tested, are fluorine-free.—(From: Science News Letter.)

Notes of Interest

Major Claude R. Wood, D. C., wishes to announce that Dr. Frank P. Bowyer, associate for the past four years of Dr. Oren A. Oliver, Nashville, Tenn., is now associated in his offices, 608 Medical Arts Bldg., Knoxville, Tenn., and 102 Central Bldg., Bristol, Tenn.

Dr. Brooks Bell announces the association of Dr. J. S. Favors in his office, Medical Arts Bldg., Dallas, Texas. Practice limited to orthodontics.

The AMERICAN JOURNAL OF ORTHODONTICS AND ORAL SURGERY feels that its readers would be glad to be informed of the change of address and location of any orthodontists who have entered the Armed Services. If this information will be sent direct to the Editor, 8022 Forsythe Blvd., St. Louis, Mo., it will be published from time to time in the NEWS AND NOTES pages of the JOURNAL.

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British Society for the Study of Orthodontics

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Secretary, R. Cutler
Treasurer, Harold Chapman

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*The Journal will make changes or additions to the above list when notified by the secretary-treasurer of the various societies. In the event societies desire more complete publication of the names of officers, this will be done upon receipt of the names from the secretary-treasurer.

†The Journal will publish the names of the president and secretary-treasurer of foreign orthodontic societies if the information is sent direct to the editor, 8022 Forsythe, St. Louis, Mo., U. S. A.

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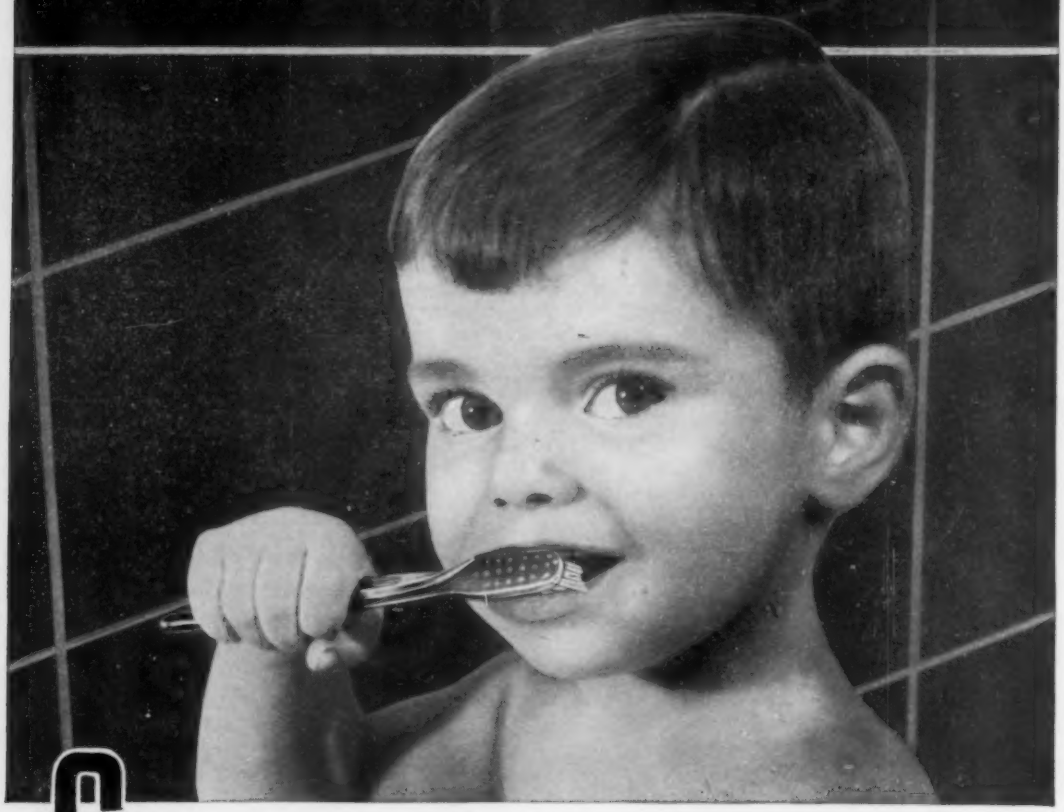
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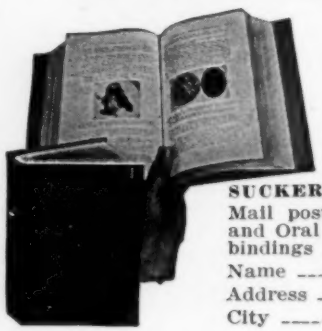
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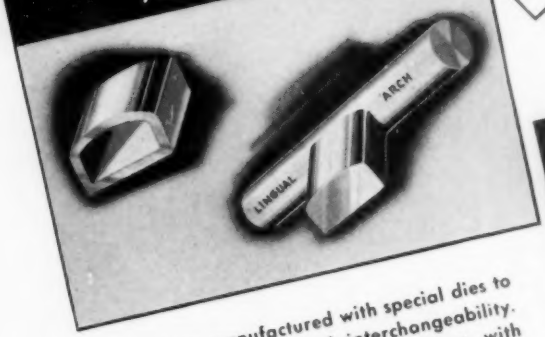
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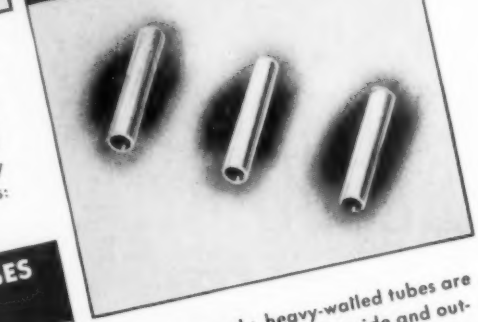


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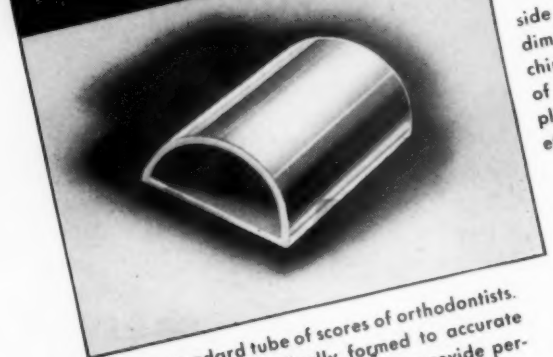
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Office of the Editor: 8022 Forsythe Boulevard, St. Louis
Published by The C. V. Mosby Company, St. Louis

American
Journal of Orthodontics
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VOL. 29 MARCH, 1943 NO. 3

Original Articles

THE DIFFERENTIAL ANALYSIS AND TREATMENT OF TWO CASES OF APPARENT MANDIBULAR PROTRACTION

JAMES JAY, D.D.S., NEW YORK, N. Y.

THESE cases present similar conditions appearing in patients of diametrically opposite racial types. The patients were treated in the Orthodontic Clinic of Columbia University.

Patient I (Fig. 1, top), a native born Negro girl, aged 14 years, was referred to the clinic by her dentist, with a complaint of impaired masticatory function due to malocclusion.

Medical history indicated that her first decade of life had furnished much to affect her inherited pattern of growth and development. She had had whooping cough and measles during the first year and chicken pox at 3 years of age. During the fourth year her tonsils and adenoids were removed. An abscessed ear was punctured at 8 years of age. The patient weighed 8½ pounds at birth, was instrument delivered and artificially fed. At 14 years she was light for her height. The habit of mouth breathing was present. Nutrition had been fair to poor.

Examination of the patient revealed little of etiologic or pertinent value. The tongue was large and oval in shape. Muscle tonicity was only fair. The teeth were apparently normal in size and structure. All teeth were present. The head form was mesocephalic, facial type was leptoprosopic. The caries index was fairly high. Poor distoclusal restorations on the mandibular first molars greatly impaired the function of these teeth.

Patient II (Fig. 2, top), a native born boy of Japanese descent, aged 14 years, was referred to the clinic from the Oral Diagnosis Division, with a complaint of poor dental function.

Medical history indicated impairment to health during the first decade. He had had whooping cough at 6 months, measles at 6 years, tonsils and adenoids re-

Read before the Fall Meeting, New York Society of Orthodontists, Nov. 9, 1942.



Fig. 2.

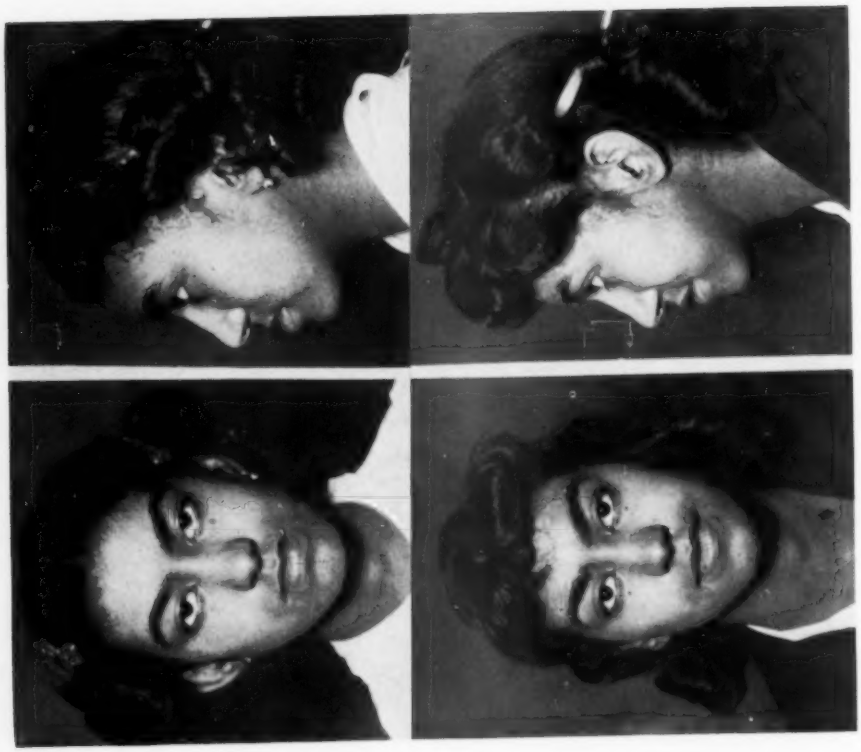


Fig. 1.

moved at 7 years. Data relating to birth and early feeding were not available. His weight was proportionate for his height. Mouth breathing was present.

Examination of the patient yielded little of etiologic or relevant significance. The tongue was large and square. The head was brachycephalic in form and the face was euryprosopic in type. Mouth hygiene was good. All teeth were present and the caries index was low. The muscle tonicity was good.

Differential gnathostatic diagnosis disclosed that although the conditions presented appear to be similar, racial type had so modified dentocranial relationships that actually the conditions are similar only when type is allowed to influence the Simon standards of comparison.

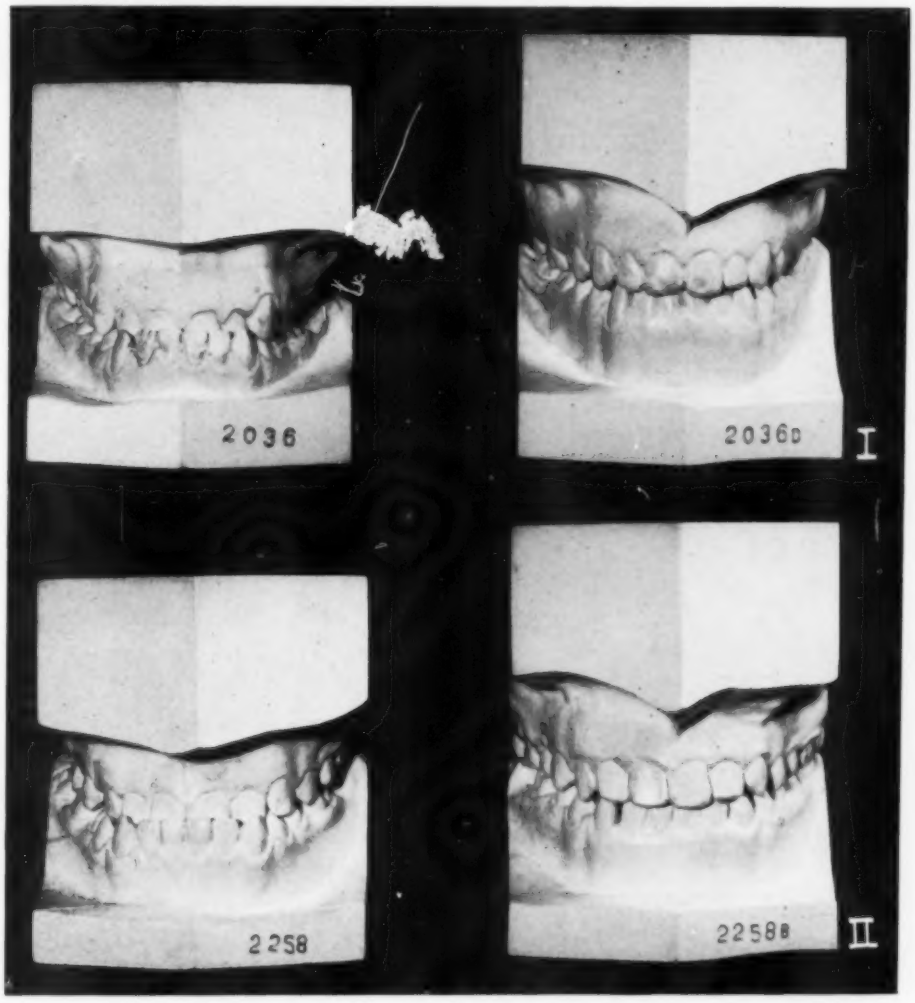


Fig. 3.

In their relations to the median plane (Fig. 3, left) the upper and lower dentures of Patients I and II were in contraction of similar degree and type.

In the relations of their dentures to the orbital plane (Fig. 4, left), Patient I showed a total, mild, asymmetrical, dental and alveolar protraction in the upper and a total, extreme, asymmetrical, mandibular protraction in the lower. Patient II, however, showed a total, medium, asymmetrical, maxillary re-

traction in the upper and a total, mild, asymmetrical, dental and alveolar retraction in the lower. (Fig. 5, left).

The relationships of their dentures to the Frankfort horizontal plane were dissimilar. Patient I presented a total, medium, asymmetrical, maxillary abstraction in the upper and a total, medium, asymmetrical, mandibular attraction in the lower denture. The findings on Patient II were negative.

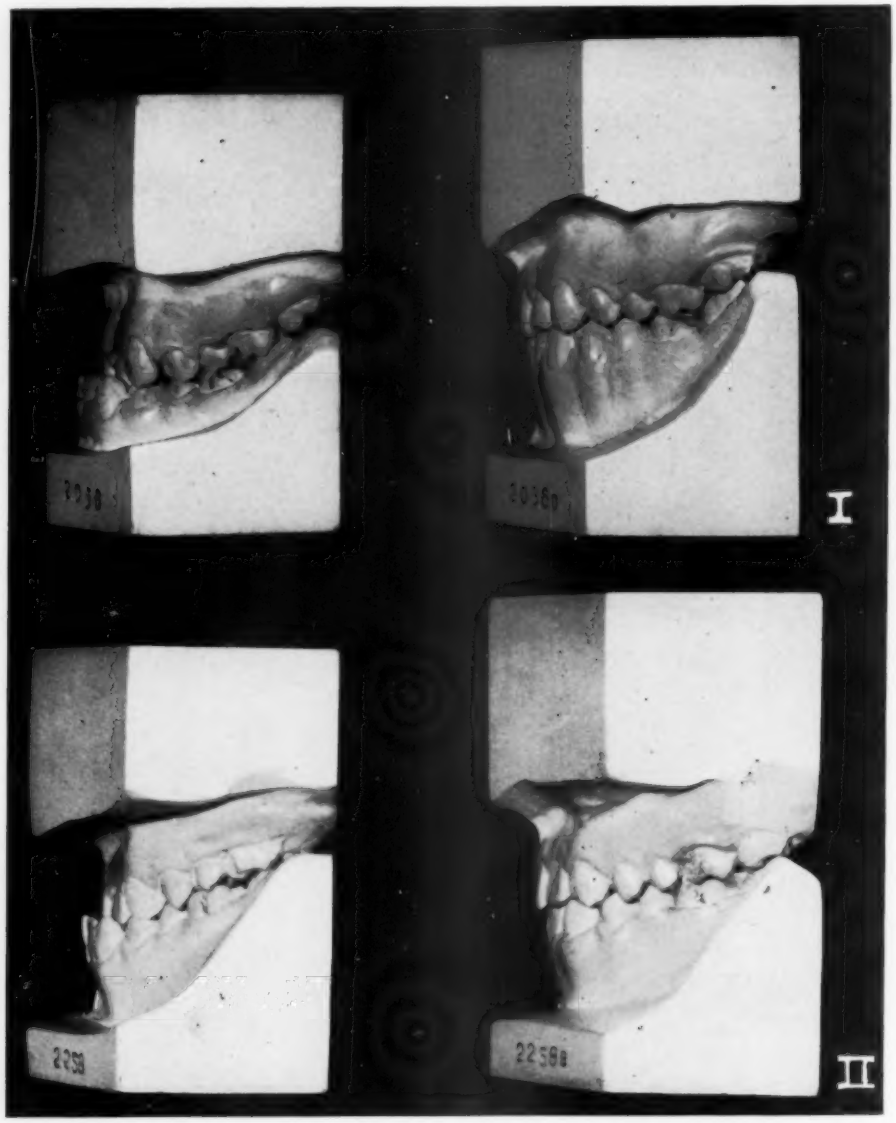


Fig. 4.

The treatment of Patient I consumed a little less than two years. During this time the general objectives were as follows: lateral development of the posterior segments of the upper and lower dentures, protraction of the upper anterior segment, retraction of the lower denture, rotations.

The mechanotherapy was accomplished by means of upper and lower lingual appliances with springs as needed, and a lower labial appliance with loop stops and intermaxillary hooks. So-called "Class III" intermaxillary elastics were

used during the greater part of the treatment and for the most part were worn at night only.

Patient II was treated for approximately one year and nine months. The general objectives of his treatment were similar to those of Patient I.

The mechanotherapy used on Patient II varied from that used on Patient I, in three respects. During treatment coil springs were substituted for loop springs on the lower labial appliance, intermaxillary elastics were worn continuously, and greater use was made of loop springs on the lower lingual appliance to send individual mandibular teeth posteriorly.

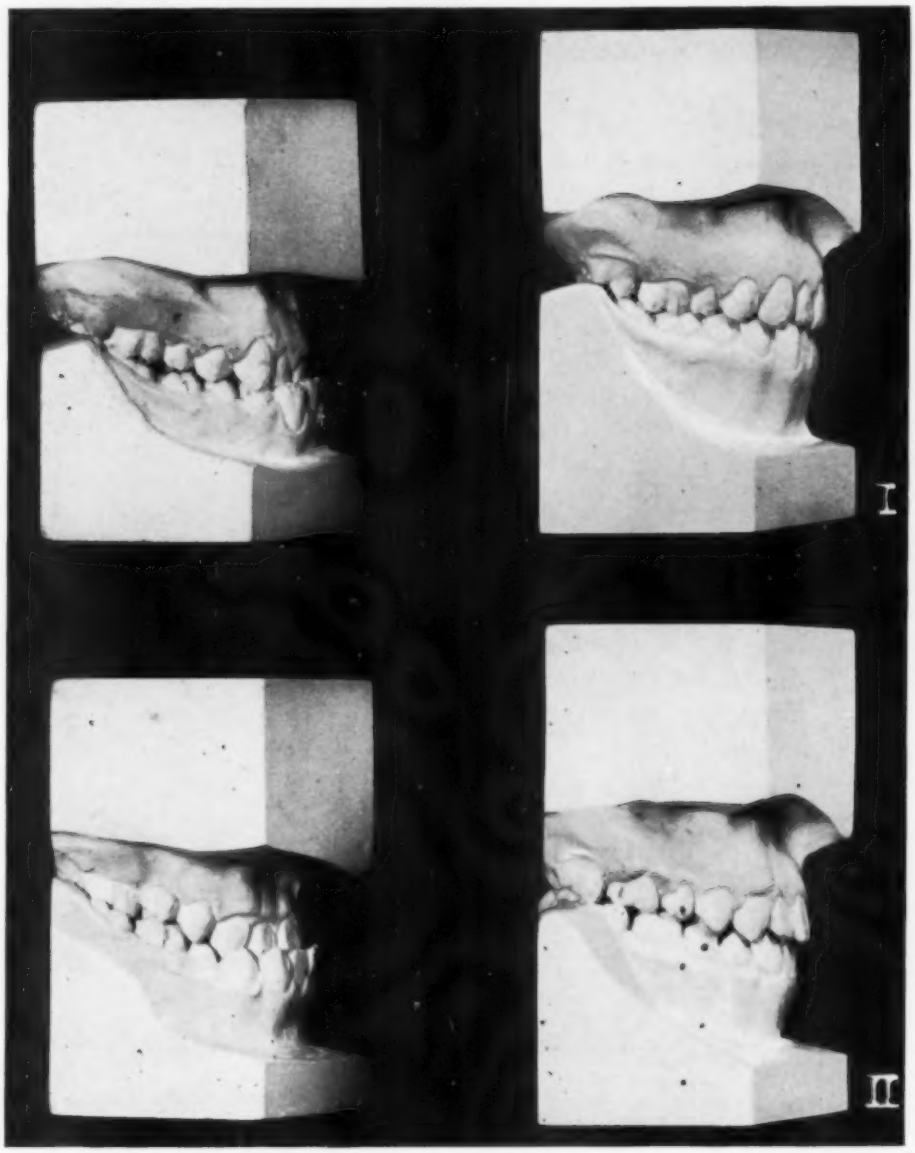


Fig. 5.

Patient I responded readily to treatment and her progress was good. Her cooperation was excellent.

The initial response to treatment of Patient II was only fair. After a short period of treatment his mandibular third molars were extracted and a much

greater degree of distal movement of the mandibular teeth was obtained than was accomplished for Patient I. It was this fact that produced the variance in mechanotherapy between these two patients.

Patient I (Fig. 1, bottom) has been free of all appliances for more than one year, and Patient II (Fig. 2, bottom) has been without appliances for a little less than six months. No retainers were used in either case. Roentgenograms (Fig. 6) taken of the completed cases shows a minimum, if any, of root resorption.

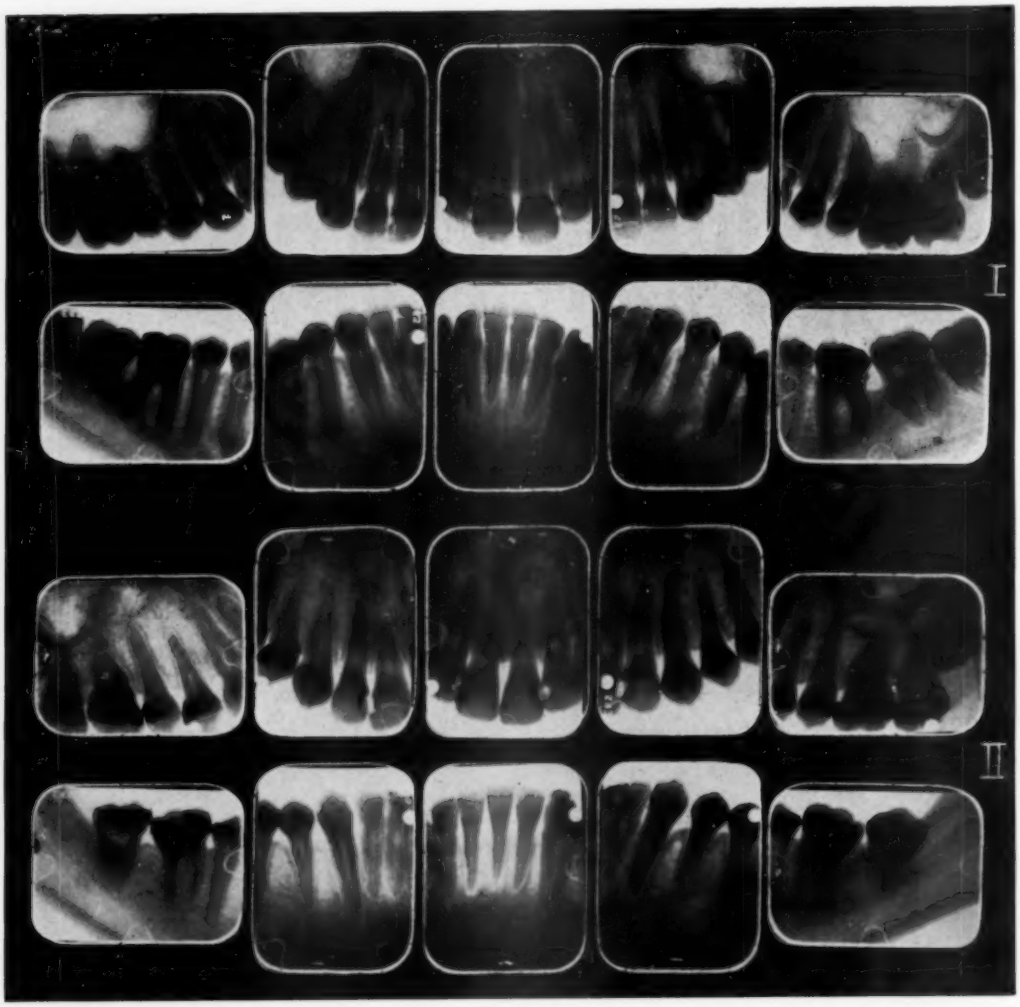


Fig. 6.

The final differential gnathostatic diagnosis reveals the following points of interest (Fig. 3, right). Both patients have improved their relations to the median plane, and to the horizontal plane. In their relations to the orbital plane (Fig. 4, right), Patient I presents a total, medium, asymmetrical, dental and alveolar protraction in the upper and a total, medium, asymmetrical, dental and alveolar protraction and mandibular retraction in the lower denture. Patient II presents a total, mild, asymmetrical, dental and alveolar protraction in the upper and a total, mild, asymmetrical, dental and alveolar retraction in the lower den-

ture (Fig. 5, right). (The occlusion on the right side of Fig. 5 for Patient II is not equal to the true occlusion due to a mishap during the photographing of this model.)

An evaluation of the initial and final gnathostatic diagnosis tends to indicate that the major movement accomplished for Patient I was that of mandibular retraction while for Patient II it was that of dental and alveolar protraction in the upper denture.

In conclusion it is of interest to note the magnitude of the influence of type upon our field of endeavor, for although we have improved the dentofacial characteristics of Patients I and II, they remain as they began, diametrically opposite racial types.

I wish to express my sincere appreciation to Dr. Arthur C. Totten for his kind assistance in preparing this case report and to the Orthodontic Division of Columbia University for placing the necessary records at my disposal.

1 West 81st Street

CLASS II, DIVISION 1

A Case Report

Samuel N. Knopf, B.S., D.D.S., New York, N. Y.

THE case to be described was one that was treated by me at New York University College of Dentistry. The patient is a white male, aged 14 years, 4 months, and of Italian extraction.

The following information was divulged while routinely taking the case history. There was a normal delivery, weight was 7¾ pounds, the patient was entirely breast-fed until bottle feeding was substituted at one year of age. At the age of 3, the patient had measles, chicken pox at 4 and mumps at 5, also frequent colds which persisted even up to the time when the patient presented for treatment.

The patient also had the following habits: mouth breathing, nail-biting, finger-sucking and the continued use of the bottle until the age of 5.

Fig. 1*A* shows a full face view and *B* a profile view of the patient before treatment was started.

Fig. 2 shows the anterior view of the teeth before treatment was started.

Fig. 3 shows the profile view of the teeth before treatment was started.

Fig. 4 shows the casts which were made at the time treatment was started.



A. *B.*

Fig. 1.

In the mandibular arch there was a loss of the permanent right first molar which caused a mesial tipping of the permanent second molar and a lingual rotation of the same. On the left side the permanent second molar has not yet erupted. The right first and second premolars tip distally and are rotated. The rest of the mandibular teeth also show exaggerated axial inclinations all tipping toward the space created by the loss of the permanent mandibular right first

Read before the Fall Meeting of the New York Society of Orthodontists, Nov. 10, 1942.

molar; because of this, the arch is narrowed, shortened anteroposteriorly, and shows a disturbed occlusal plane with a loss of vertical height.

In the maxillary arch all of the posterior teeth manifest a mesioaxial inclination and the anterior teeth show a marked labioaxial inclination.

There is a disturbed function of the lips. The lower lip is thick and curled and presses forward against the lingual surfaces of the maxillary anterior teeth.

Fig. 2.



Fig. 3.

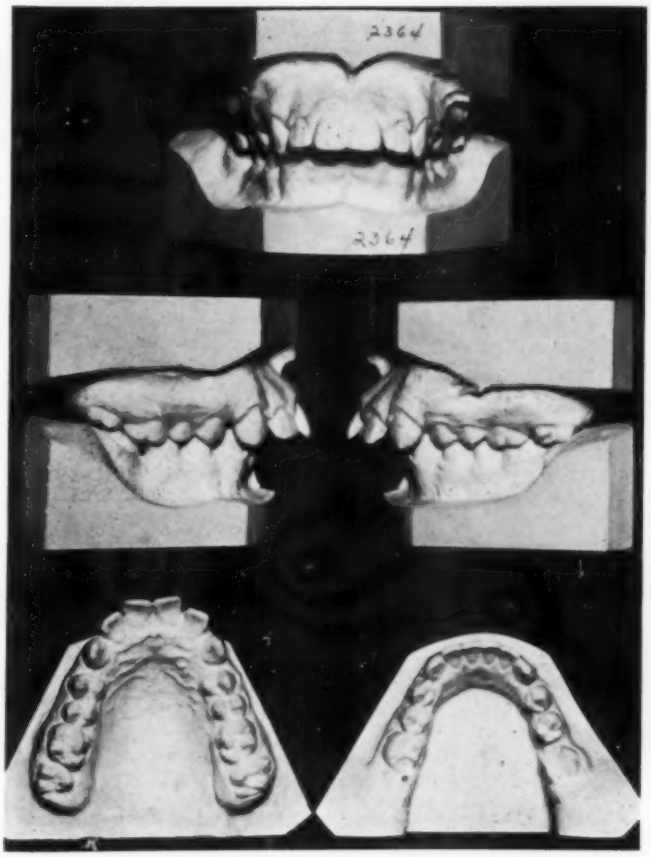


Fig. 4.

Fig. 5 shows the radiographs of the maxillary and mandibular anterior teeth prior to treatment.

Fig. 6 shows the radiographs of the right side prior to treatment.

Fig. 7 shows the radiographs of the left side prior to treatment.

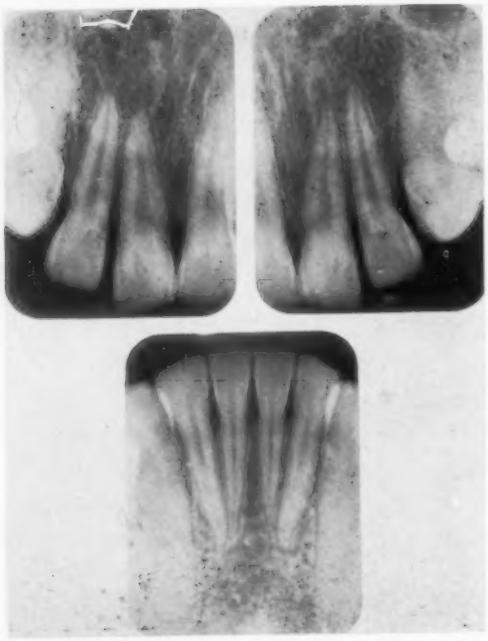


Fig. 5.



Fig 6.

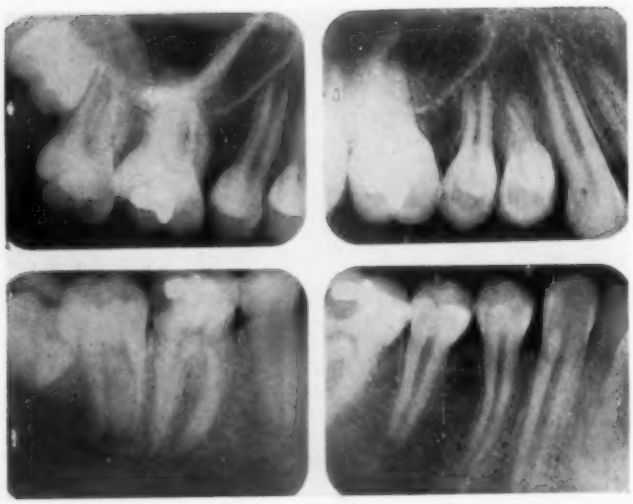


Fig. 7.

The factors responsible for this malocclusion are the continued use of artificial feeding until the age of 5, thumb-sucking, mouth breathing and the loss of the permanent mandibular right first molar.

The general plan of treatment included the correction of the abnormal axial inclinations and the elimination of the rotations of the teeth and the opening of the space for the missing permanent mandibular right first molar. The appliances used were round labial arch wires 0.040 inch in diameter and bands were used wherever indicated. The patient was seen at intervals of approximately two weeks and the entire treatment extended over a period of fourteen months.

Fig. 8 shows casts when active treatment was completed.

Fig. 9 shows the radiographs of the incisors at completion of the treatment. It will be noted that there is slight resorption of the apices of the incisors.

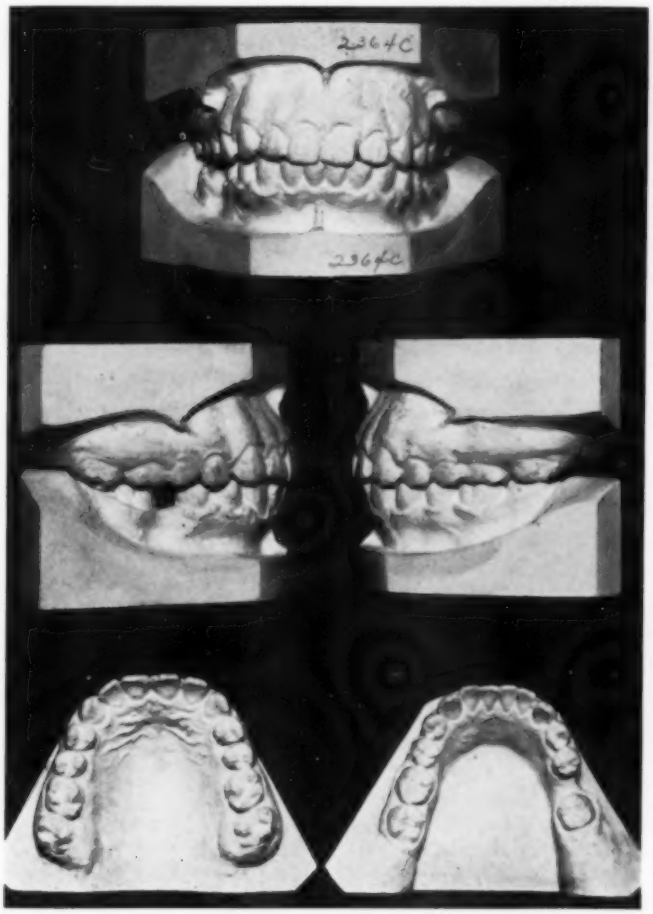


Fig. 8.

Fig. 10 shows radiographs of the right side at completion of the active treatment, with the space for the permanent mandibular right first molar re-established.

Fig. 11 shows radiographs of the left side upon the completion of the treatment.

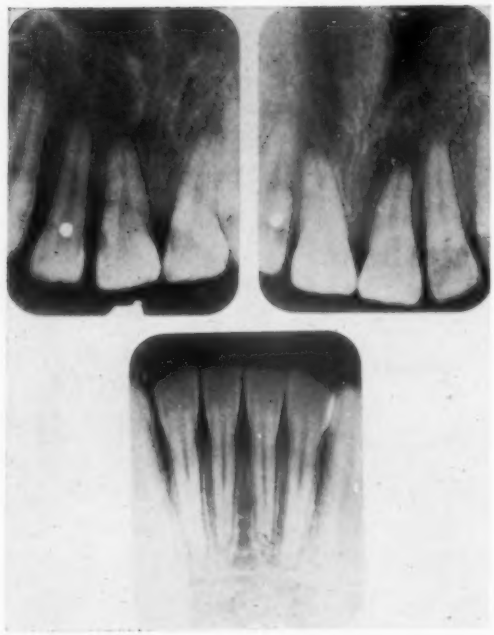


Fig. 9.



Fig. 10.



Fig. 11.

When the normal occlusal relationship was established a Hawley retainer was placed on the maxillary arch and kept there for a period of two months. In the mandibular arch a vulcanite space retainer was inserted to facilitate the operative procedure necessary for the restoration of the missing permanent mandibular right first molar. This also functioned as a retainer for the lower arch. This appliance was kept in place during the three weeks necessary for the completion of a restoration for the missing mandibular molar tooth.

Fig. 12 shows the casts with the missing permanent first molar restored.

Fig. 13 shows an anterior view of the teeth when the case was completed.

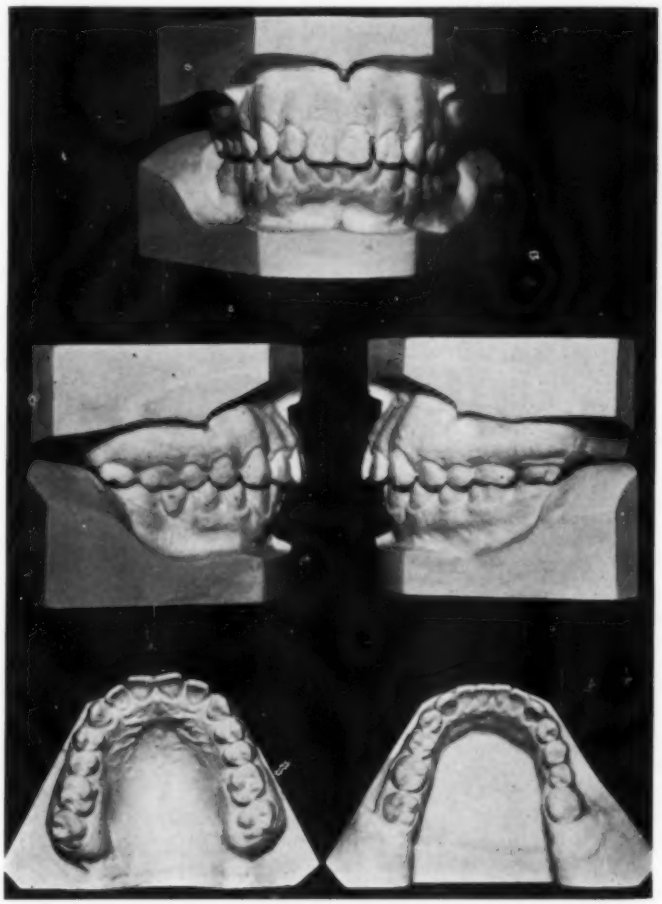


Fig. 12.



Fig. 13.

Fig. 14 shows a full face and a profile view after all retention was removed. Here it will be noted that the patient now has normal lip function and breathes normally through the nose.

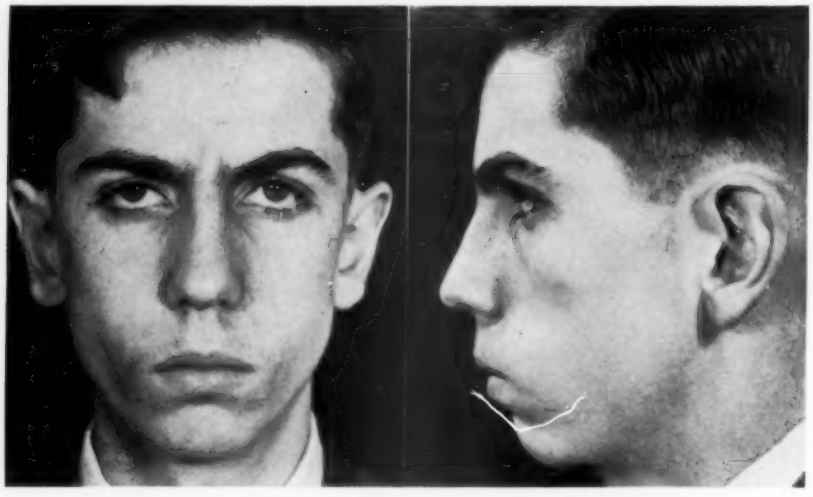


Fig. 14.

The end results of the treatment have been maintained throughout a period of six months after all retaining appliances were removed and there is every indication for the further continuance of this end result.

I here express my sincere gratefulness to Dr. Samuel Hemley, Professor of Orthodontia, New York College of Dentistry, not only for the privilege of having been one of his students, but also for his valuable aid in the preparation of this report.

RESECTION OF THE MANDIBLE

A Method That Simplifies and Overcomes the Defects of Cases Reported in the Past

William Herndon Pearson, D.D.S., Norfolk, Va.

THERE have been many attempts to correct extreme Class III cases surgically, some successfully and others with more or less failure. Let me review some of the methods used in the past.

As far back as 1840 Hullihan was doing surgery of the jaws and in 1848 did the pioneer operation upon a Class III case, which was not very successful. In 1898, Blair did the first reported case of osteotomy of the mandible, successfully. In his textbook, *Surgery of the Mouth and Jaws,* he outlines two operations. The first is one in which an incision was made under the ramus and through the cheek; a Gigli saw was passed severing the bone on each side posterior to the third molar and the mandible placed in occlusion with the maxillary teeth ligated in that position. The second method advocated was the removal of the molar or bicuspid on each side of the mandible; a section of bone was removed intraorally and the parts were set and fixed as in a compound fracture. In both of these operations the nerves and blood vessels were severed.

V. H. Kazanjian, Boston, Mass., reported to the Dental Centenary celebration in March, 1941, thirteen cases operated on through the body of the mandible and seven cases by sectioning the ramus of the mandible. With the exception of a few complications in a few of these cases, they were all successful. Dr. R. C. Willett of Peoria, Ill., reported a case of his treated orthodontically in preparation for surgery; later Dr. Schultz of Chicago operated, on June 16, 1925, taking out section where the teeth had been lost and the procedure by Blair was followed.

Drs. Watkins and Simpson of London, England, reported a case to the British Society for the Study of Orthodontics in which they sawed through the ramus just above the dental foramen, following the technique of Blair.

Dr. Arthur S. Haynen, New York, reported a case in the Journal, August, 1940, in which he resected the ramus on each side following about the same technique suggested by Blair.

Weiss, Lentz, and Newman, reported a case to this Society Nov. 1, 1940, whose procedure followed Blair's technique of bilateral osteotomy of the ascending ramus. They differed from some of the cases by having the orthodontic operation after the surgery.

Dr. Joseph E. Schaefer of Chicago, Ill., reported several cases in the American Journal of Orthodontics and Oral Surgery, April, 1941, in which his procedure in two cases followed Blair's. He reported another case in which he followed the technique of Dr. F. Kostečka of Prague, Czechoslovakia, severing the ramus from the sigmoid notch to a point two centimeters below the ear; this procedure was used by him in a case of open-bite.

Read before the Fall Meeting of the New York Society of Orthodontists, Nov. 10, 1942.

In the report of these cases you will note that the question of etiology has not entered the picture with the exception of Dr. Kazanjian's report and this condition holds good in the majority of cases reported in orthodontics. It is my firm belief that no operation, orthodontic or surgical, should be attempted until the cause of the deformity is identified, or else, whoever the operator, he is quoting failure in the end. Unless the causes of malocclusion are removed, the deformity will reappear, no matter how beautiful the result we may have obtained.

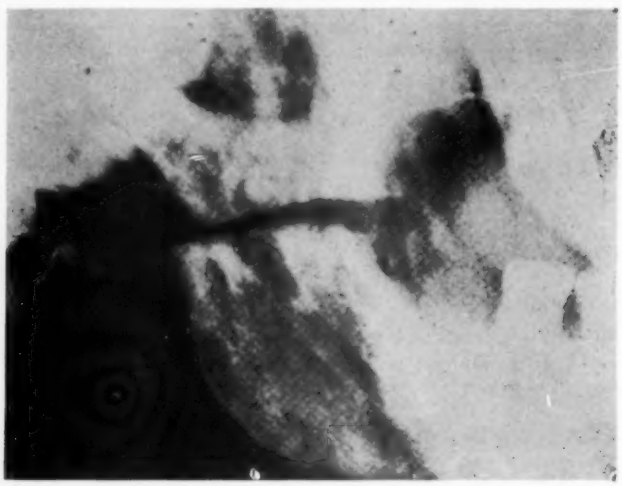


Fig. 1.—Blair's method.

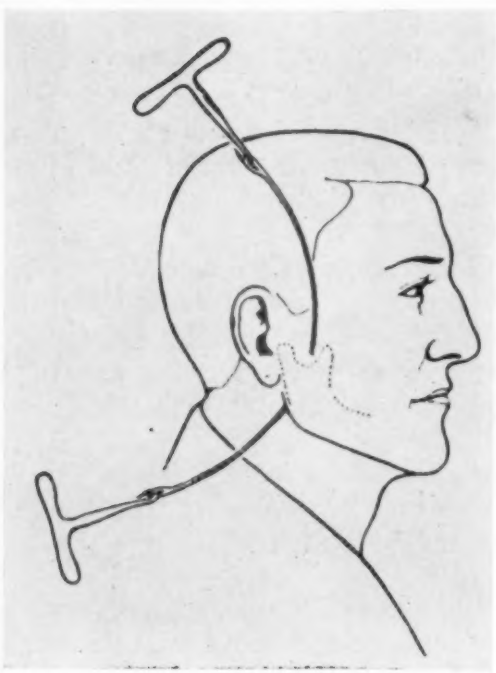


Fig. 2.—Kostecka's method.

I shall report two cases the etiology of which was entirely different. In April, 1923, Miss J., aged 15, presented for treatment of an extreme Class III case.

Diagnosis.—Abnormal deglutition had been present from early childhood due primarily to enlarged tonsils and adenoids associated with mouth breathing, causing malfunction of the muscles of deglutition and mastication; the tongue was carried against the alveolar process and incisor teeth of the mandible at all times and was especially active in articulation and deglutition. Tonsillectomy had been performed but function had evidently not been considered; hence, the habit had been continued. She had been relieved of the pathology and that was all. The mental state was tha' frequently found in these extreme cases, a very bad inferiority complex.

Treatment.—Normal function of the tongue in deglutition and articulation was begun and mouth breathing corrected. I then installed appliances to correct the case orthodontically. After spending the better part of a year, with but little results in establishing normal occlusion and the relation of the jaws, I decided to get the consent of the patient and her parents to resort to surgery. This, they readily agreed to, since she had been growing more abnormal as the years went by and they were glad to take the surgical chance to have her improved.

Now for the source of my idea as to the procedure indicated surgically in this case.



Fig. 3.

Since I had had a fair amount of experience in fractures where bone had been improperly set and had to be refractured, I used a bone bur after making incision and lifting the periosteum; cutting through the compact bone lingually and buccally at the site of fracture, being careful not to impinge on nerve or blood vessels, then inserting a chisel, I found it quite easy to fracture the mandible and reset it.

To be sure of my position before operating on Miss J., I solicited the assistance of an outstanding surgeon of our city, Dr. Lomax Gwathmey, and informed him of my problem, with an idea of the procedure. He replied, "it sounds feasible," and suggested that we try the operation on a cadaver, if we could get a fresh subject. In a few days he called me to be ready in a few minutes, as a fresh cadaver was available at the morgue. We took our equipment and did the operation as outlined, which proved a success.

I made an appointment with Miss J., for April 29, 1924, and with the assistance of Dr. Gwathmey, I proceeded as follows: Patient was anesthetized, using rectal anesthesia, vapor chloroform. A small incision was made inside the mouth posterior to the third molar, parallel to the long axis of the mandible.

The periosteum was pared from each side, then a small fissure bone bur was inserted, cutting through the compact bone lingually and buccally as far down as I could reach, being careful not to impinge on nerve and blood vessels. A chisel was then placed in the incision and the bone was fractured; the same procedure was employed on the opposite side. Having the bone severed, the soft tissues were brought together and sutured. This required only one stitch on each side. The ramus was pushed back a little, the mandible lowered in the posterior where it had been fractured, and the anterior was raised into occlusion,



Fig. 4*A*.



Fig. 4*B*.

fixing the maxilla and mandible together with wire ligatures. The ligatures were attached to appliances that were on her teeth. She was in the hospital twelve days. The jaws were retained in position five weeks at which time

appliances were removed, and the patient was dismissed. She was observed for about twelve months with no change of position of the jaws and teeth, except an improved occlusion. I saw this patient again two or three years ago and the mandible had retained its position as of time of operation.

You will notice from the illustrations the young lady now has a nice angle to her jaw which was lacking before the surgical interference and her features are well balanced. This case was reported at the Edward H. Angle Society, Pasadena, Calif., July, 1924, but was not published.

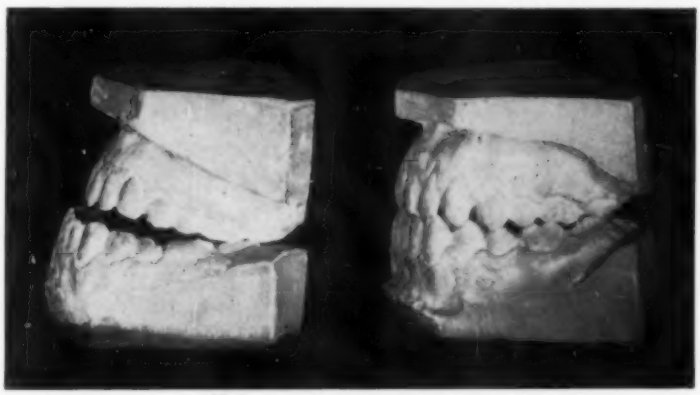


Fig. 5A.



Fig. 5B.

A.  B.

Fig. 6.

Second case: Miss B., aged 32, presented herself for treatment in July, 1941, with extreme Class III case.

Diagnosis.—Abnormal articulation and deglutition were present all of her life due to defective frenum linguae; the tongue was so laced down she could not raise it above the incisal edges of the lower incisors. Hence, in the act of

articulating and swallowing, the tongue was forced against the alveolar process and the incisors of the mandible constantly, stimulating these teeth forward.

Treatment.—Frenum linguae was corrected surgically and normal function of muscles of deglutition started. Models of the case were made, and it was found that the superior maxillary was too narrow through the cuspid and premolar region.

On Oct. 16, 1941, appliances were installed on the maxillary teeth to develop them to conform to the mandibular set. This being accomplished, Miss B. was admitted to Lee Memorial Hospital, Feb. 19, 1942. Resection of the mandible was accomplished, using the same technique as in the preceding case with the exception of the anesthetic, sodium pentothal, used intravenously.



Fig. 7.

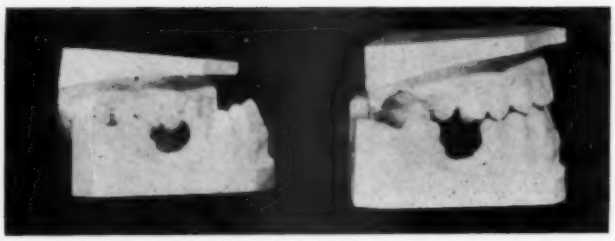


Fig. 8A.



Fig. 8B.

In the last three cases I have used this anesthetic and find it very satisfactory. Prognosis was good; the patient left the hospital Feb. 24, five days after the operation. Fracture had healed completely by first intention and the inferiority complex showed improvement at once.

SUMMARY

Etiology of all cases should be found and the correction of it begun.

When orthodontic treatment is indicated, it should be accomplished before surgery in order that the teeth and jaws can be placed in their normal occlusal relation.

In all extreme cases of prognathism there is but little angle to the mandible, but this method gives the opportunity to make an angle.

This surgical procedure does not interfere with the nerve and blood supply of the parts except to stretch them a little.

There are no scars to mar the face and this technique causes comparatively little discomfort to the patient.

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709 WAINWRIGHT BLDG.

THE OCCLUSAL GUIDE PLANE

A Discussion

Oren A. Oliver, D.D.S., Nashville, Tenn.

IN THE advancement of dentistry, much effort is expended in teaching fundamental sciences and component phases of essential approaches. These basic things are necessary. The full benefit to the profession, however, cannot be gained until there is a comprehensive clinical application made in order to test, under working conditions, specific theories, claims, and combinations of basic facts. Often, as we seek to advance our professional range and skill, we do not give sufficient attention to the important fact that diagnosis involves an orderly procedure which is just the reverse of that to which the student of dogmatic dictum has accustomed his thinking and practice. The paper which is here presented is a guide to a definite and challenging procedure in the field of orthodontics.

The role that orthodontics is now assuming in the general advancement of American health is very important. It cannot be maintained unless there is constant new achievement in technique and in mastery of basic facts. No orthodontic service should be attempted unless the operator possesses a really fundamental understanding of general systemic conditions, their incidence in each patient, and their relation in general and in particular to the service he seeks to render. So far as separate items go, there is actually little original thought in orthodontics per se, but there is a great deal of combination and integration of facts long known. And this new use of basic facts does constitute a new science. But this science can only fill its "place in the sun" as each and every contribution to the whole is based on a firm foundation. Let us be resourceful. Let us be thorough. There is no science without scientists; and scientists are not born, they are made. Pasteur once said, "Science, in order to be useful, must convince all opponents, exhaust every hypothesis." Let us always admire a patient, conscientious man in our profession who has the spirit of inquiry, the courage of his convictions, and the power to put his new facts and ideas before his fellow men.

In orthodontics a great deal of experimentation and research is going forward. Many earnest workers are striving to improve the methods and possibilities of this phase of health service. As a contribution to our effort, this paper on the technique of lingual and labial arch construction is offered.

The appliance now described in detail has been made and employed many times. What is described is not to be considered, in an orthodontic sense, to be a bite plane, for its purpose is not that of completely contacting in occlusion the mandibular anterior teeth. Instead of this, the appliance is for the purpose of changing the whole relation of the mandibular to the maxillary teeth, anterior

Given before First Inter-American Orthodontic Congress, New Orleans, La., March 16 to 21, 1942.

Figs. 1 through 23 are taken from Oliver, Irish, Wood: Labio-Lingual Technic, 1940, The C. V. Mosby Co.

and posterior, both when the mandible is in motion and when it is at rest, thus definitely establishing a new normal anteroposterior relationship. It is not my purpose at this time to dwell upon the uses of the occlusal guide plane, but to present in detail its construction.

The occlusal guide plane is defined as follows:

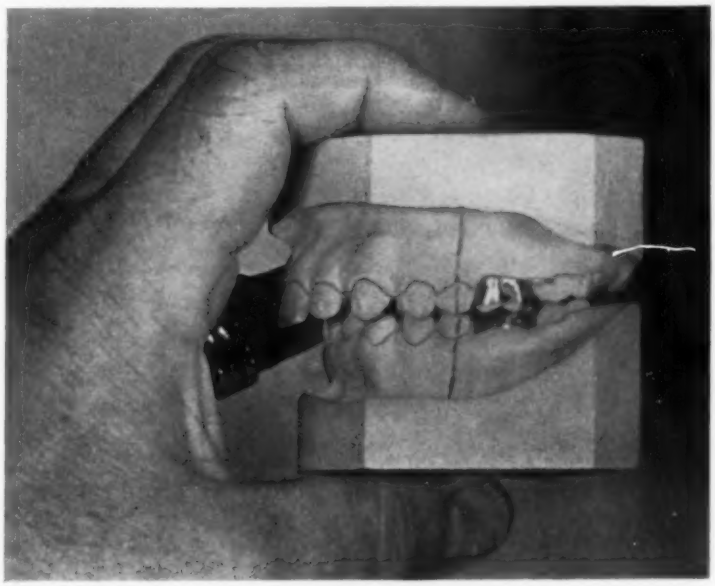


Fig. 1.—Right lateral view of models showing perpendicular pencil marks which record occlusion prior to correction; that is, as it is in the mouth. Such recording is necessary during guide plane construction.

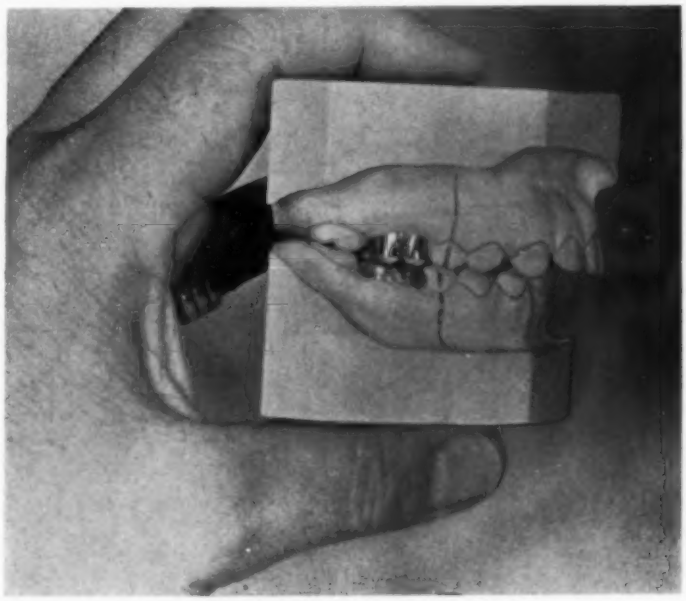


Fig. 2.—Left lateral view of models showing perpendicular markings. Purpose same as in Fig. 1.

A mechanical device having an established inclined plane which, when in use, causes a change in the occlusal relation of the maxillary and mandibular teeth and permits their movement to a normal position.

If the occlusal guide plane were to function as a bite plane, it would be so constructed as to permit direct continuous contact with the mandibular anterior teeth when in occlusion and during motion.

The occlusal guide plane must not be classed as, nor confused with, a bite plane, if any success is to be expected or had from its use.

The first, most fundamental step in building an occlusal guide plane is the construction of the guide wire as an important part in furthering the advancement of the lingual arch technique. It will seem to some dentists who are not familiar with the construction of the occlusal guide plane rather unusual

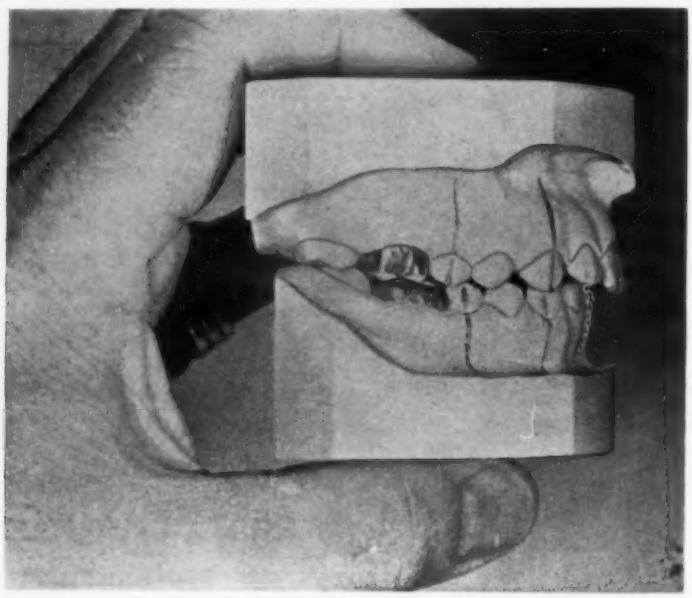


Fig. 3.—Right lateral view of models occluded and marked in cuspid region. This is the relation the teeth will have when completed guide plane is placed in mouth. The guide is constructed to meet the relation according to perpendicular line on cuspids.

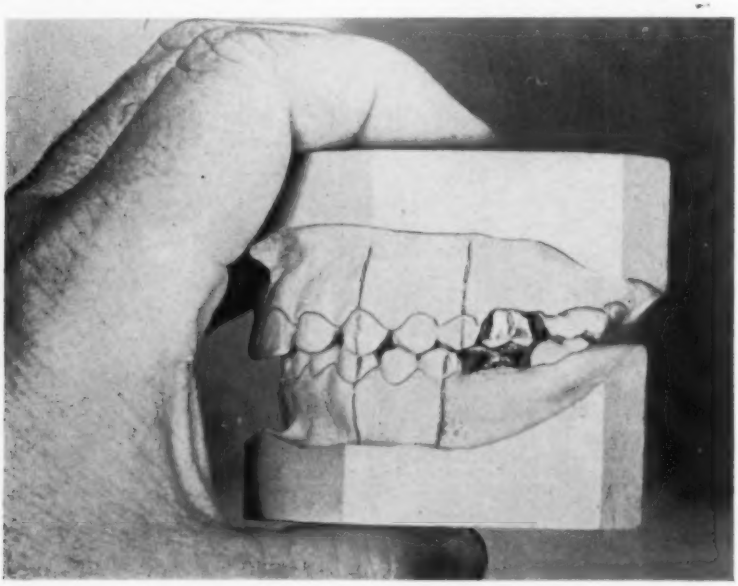


Fig. 4.—Left lateral view duplicate of preceding right lateral view. Note disrelation of lines on the premolars. This comparison shows shift forward necessary for correct relation which is recorded by cuspid markings.

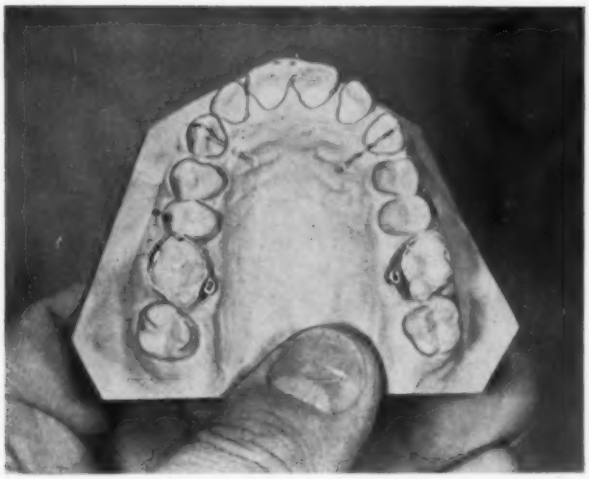


Fig. 5.—Upper model, showing pencil line extensions lingually on cuspids.

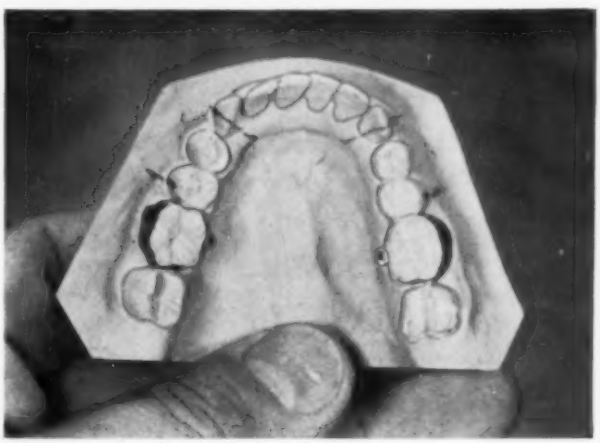


Fig. 6.—Lower model, showing pencil line extensions lingually on cuspids.



Fig. 7.—Upper lingual appliance in position on marked work model. Ready for guide plane construction.

that first consideration in building it is given the mandibular lingual arch, even though the occlusal guide plane is actually itself a maxillary appliance. But very definite reasons place the mandibular lingual arch first in consideration. Some facts about this are now stated briefly.

First, the depth must be established. To determine the proper depth, or height, of the occlusal guide wire it is necessary that the mandibular lingual arch be first constructed as a base from which to work. Were this not done, there would be no way of determining exactly how far down (or that is, in the direction of the lower anterior teeth) the occlusal guide wire should extend when it is in its correct position.

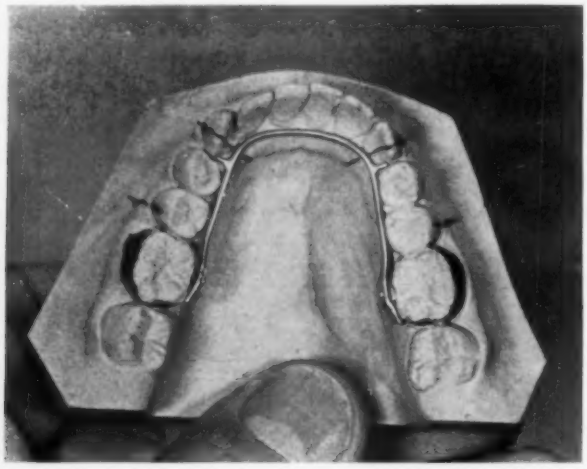


Fig. 8.—Lower lingual appliance in position on work model. Ready for guide plane construction.

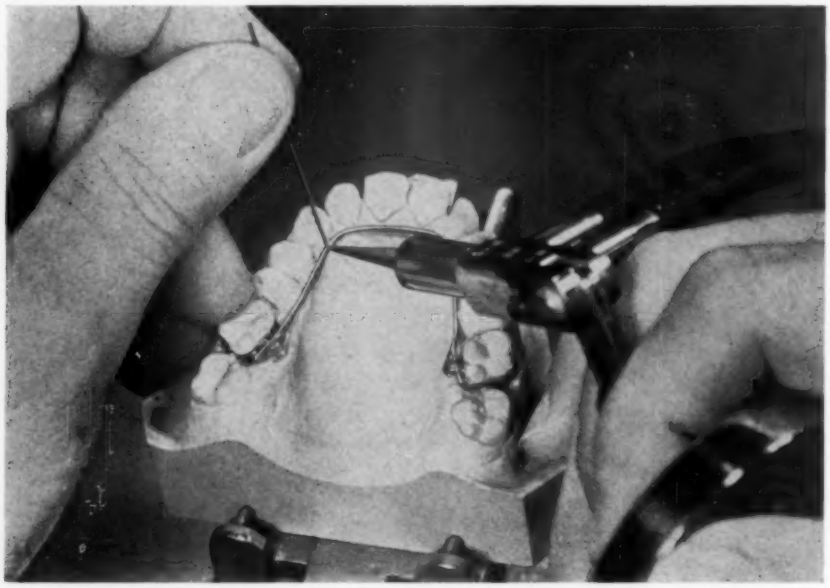


Fig. 9.—Soldering 0.030" wire perpendicularly on lingual appliance.

Second, when the teeth are occluded, the guide wire should approximate the anteroclusal surface of the mandibular lingual arch. If space, in the

relation of the occlusal guide wire to the mandibular lingual arch, is necessitated, this space should not exceed one-half millimeter.

Third, the occlusal guide wire extends in relation to the maxillary lingual arch and the maxillary teeth, from a designated point bisecting the canines and forming a horizontal curve paralleling and approximating the anterior portion of the maxillary lingual arch, also being symmetrical to the anterior portion of the mandibular lingual arch and, of course, generally conforming to the arc as represented by the lingual surface of the mandibular anterior teeth.

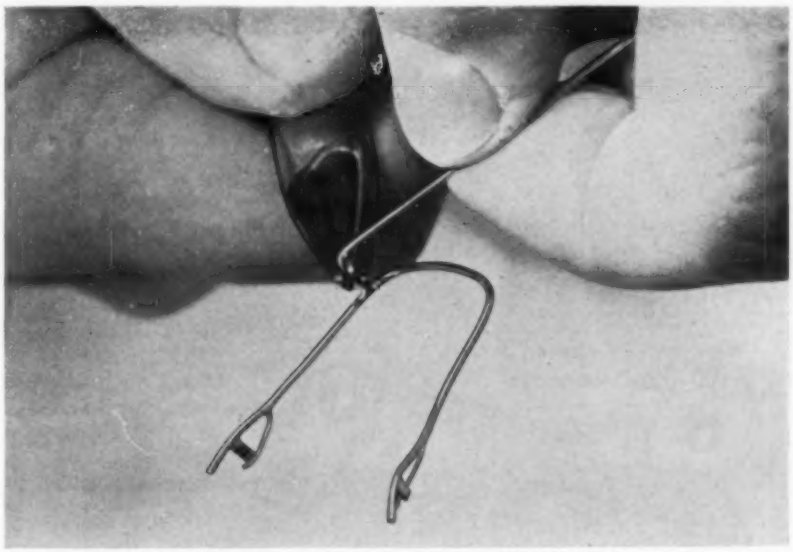


Fig. 10.—Forming obtuse angle and bending 0.030" wire anteriorly. Clearance with lower lingual appliance is 1/64".

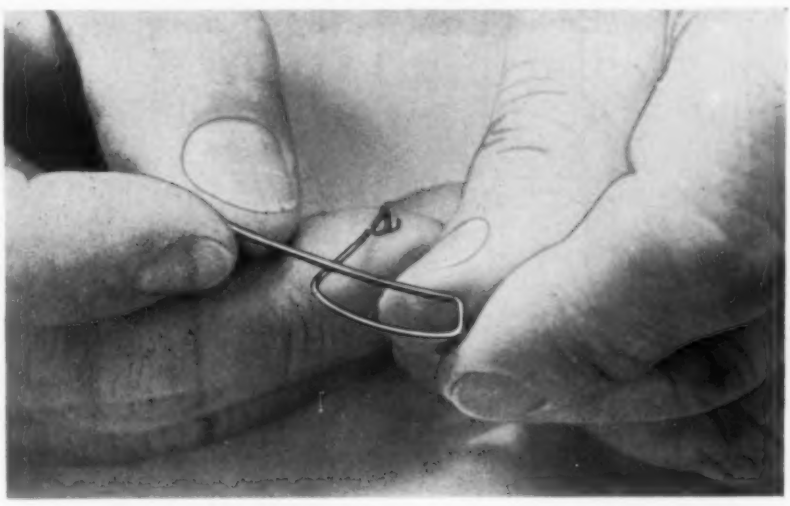


Fig. 11.—Shaping horizontal section of 0.030" wire with fingers.

And fourth, the mandibular lingual arch is so constructed as to permit the occlusal guide wire to rest on the anterior portion, or slightly above and between the mandibular lingual arch and the linguogingival ridge of the lateral and central incisors, also approximating a midline point of the two mandibular canines.

We turn now from the mandible to the maxillary arch. The maxillary lingual arch is so constructed as to meet the necessary requirements of treatment of the posterior teeth. The anterior portion of the maxillary arch should approximate the linguogingival ridge of the maxillary four incisors as closely as the degree of the overbite will allow.



Fig. 12.—Bending 0.030" wire posteriorly on unattached side.



Fig. 13.—Cutting the 0.030" wire at approximately the second premolar area.

Both the maxillary and mandibular arches must, as the next step, be carefully occluded on models. With the maxillary and mandibular lingual arches in position on the models, occlude the models in the exact anteroposterior relation desired when the occlusal guide plane is completed. The relation the dentist desires the teeth to assume when the occlusal guide plane is placed in the mouth represents as accurately as possible the normal anteroposterior relation of the first permanent molars, premolars, and canines.

Second, holding the models properly occluded in correct position as above stated, draw a straight line, with a pencil, on the models from the midline of the upper canines through the lower canine area. A straight line should also be drawn from the midline of the maxillary model to the mandibular model. On the posterior portion of the occluded models straight lines are drawn at the area behind the last molar teeth, from the maxillary to the mandibular models.

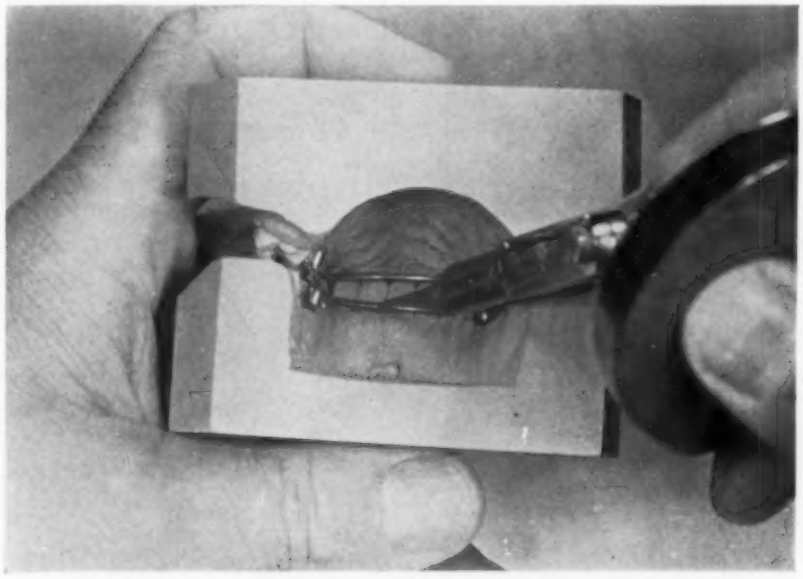


Fig. 14.—Applying heat to render 0.030″ wire passive.

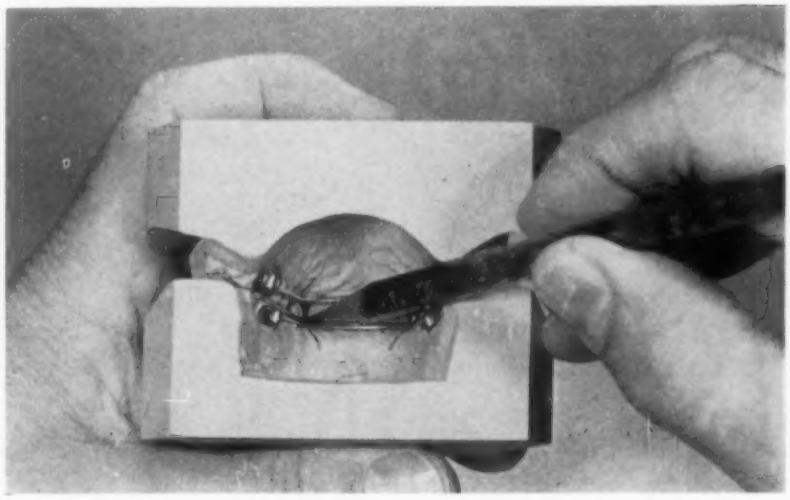


Fig. 15.—Marking 0.030″ wire at a point directly above pencil mark as made on cuspid.

Third, separate the models. With the occlusal surface of the teeth facing you, extend the line on the buccal surface of the maxillary canines to the lingual surface of the maxillary canines, from the incisal to the gingival.

Fourth, with the models separated and the occlusal surface of the teeth facing you, extend the line on the buccal surface of the mandibular canines to the lingual surface of the mandibular canines from the incisal to gingival.

Let us now discuss the construction of the occlusal guide wire on the maxillary lingual arch. In doing this, first remove from occlusion the maxillary model. With a file, mark the maxillary lingual arch at the point the lines on the lingual surface of the maxillary canine teeth would contact the lingual arch.

Second, flux lingual arch wire and fuse 18K solder at the points marked by the file.

Third, holding the models in occlusion, with the lines previously inscribed being parallel with one another, turn the models so that the lingual surfaces of the anterior teeth are clearly and conveniently visible from the posterior. This is the time to approximate the depth of the anterior bend in the 0.030 wire. The depth will be the distance from the maxillary to the mandibular lingual arch.

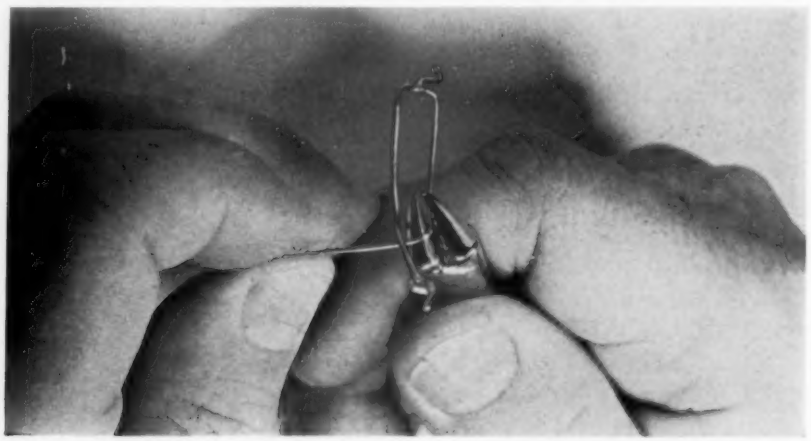


Fig. 16.—Bending disengaged marked side of 0.030'' wire anteriorly and downward to contact appliance.

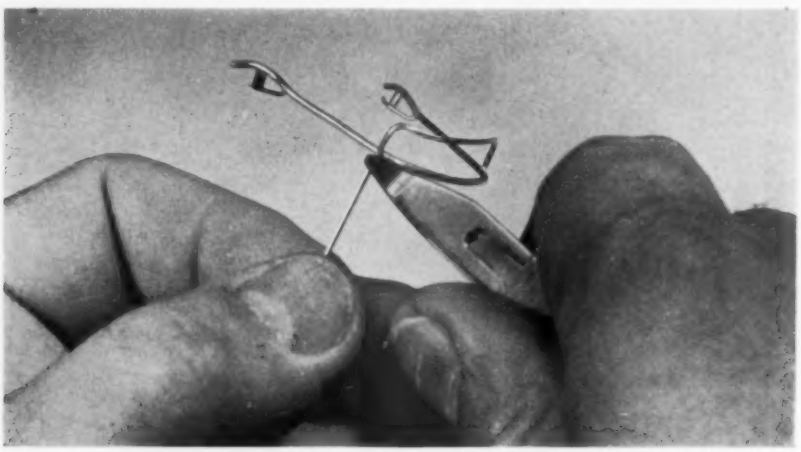


Fig. 17.—Cutting off excess 0.030'' wire at exact point of marking.

Fourth, a 0.030 wire of sufficient length is passed through the flame, heated to a cherry red, then quickly immersed in water for the purpose of annealing or removing the temper of the wire.

Fifth, with the model conveniently held, occlusal surfaces facing you, one end of the 0.030 wire is soldered perpendicularly on the left side of the lingual arch where the solder has been previously fused.

Sixth, the lingual arch is then removed from the model with the 0.030 wire attached at the left side. A right angle bend, toward the anterior, approximately depth between maxillary and mandibular lingual arches, is then made in the 0.030 wire. The unattached end of the 0.030 wire is next roughly conformed by finger to the angle of the anterior portion of the maxillary lingual arch. The unattached end of the 0.030 wire is cut at approximately the second premolar area on the maxillary lingual arch.

Seventh, the 0.030 wire is then shaped with pliers and fingers, to conform to the convexity or symmetry of the anterior portion of the maxillary and mandibular lingual arches. This symmetry will follow in contour an arc as represented by the lingual surfaces of mandibular teeth. Eighth, before making the band in the opposite side (the free end or right side) of the 0.030 wire, place the maxillary lingual arch, with the occlusal guide wire thus far adapted in position, on the maxillary model. Occlude correctly the maxillary and mandibular models; apply heat from the posterior of the models, to make the guide wire passive. Be certain when annealing the occlusal guide wire that it is approximating the mandibular lingual arch as stated. The 0.030 wire must lie in contact with the lingual surfaces of the mandibular anterior teeth as well as approximate the mandibular lingual arch with the models in correct occlusion.

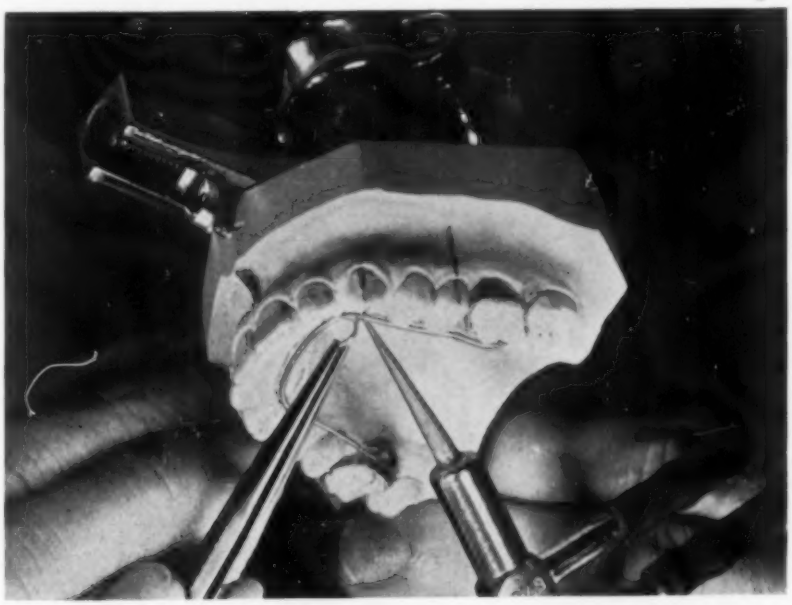


Fig. 18.—Soldering disengaged end of 0.030" wire to lingual appliance. Wire is soldered at point where appliance was marked.

Ninth, with the models, the maxillary and mandibular lingual arches, and the occlusal guide wire in the relation as completed above, mark the free end of the occlusal guide wire at a point denoted by the line previously drawn on the lingual surface of the maxillary right canine.

Tenth, remove the maxillary lingual arch, with the occlusal guide wire conformed and marked for bending. Bend the unattached end at the point previously marked. Bend the 0.030 wire anteriorly and toward the lingual arch. Then cut the 0.030 wire so that the free end, bent at an angle, rests at the

point where the 18K solder has been previously placed and fused. (This constitutes the top or occlusal portion of the maxillary lingual arch wire.)

Eleventh, at this point both ends are attached, and some minor adjustments with pliers may be necessary. Among these are the following: (1) It may be necessary to disengage one side and then to resolder. (2) The guide wire may need to be moved posteriorly, laterally, or anteriorly for satisfactory conformity and approximation.

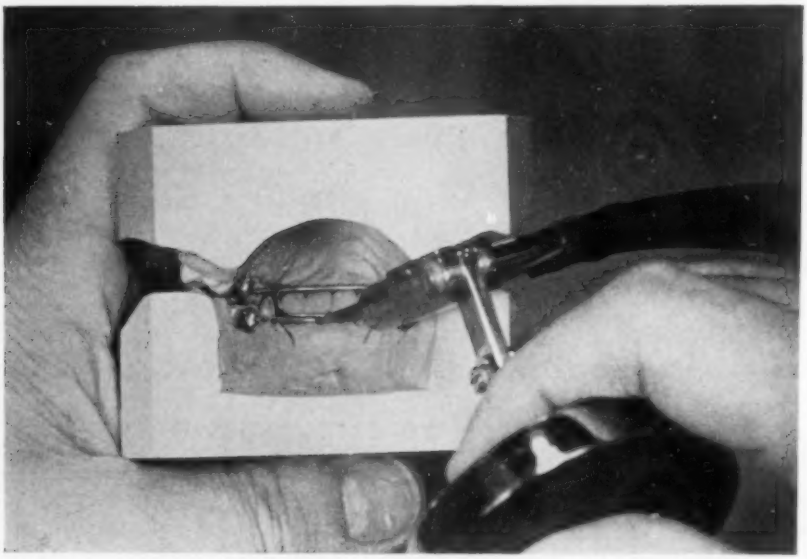


Fig. 19.—Rendering the attached 0.030" wire passive.

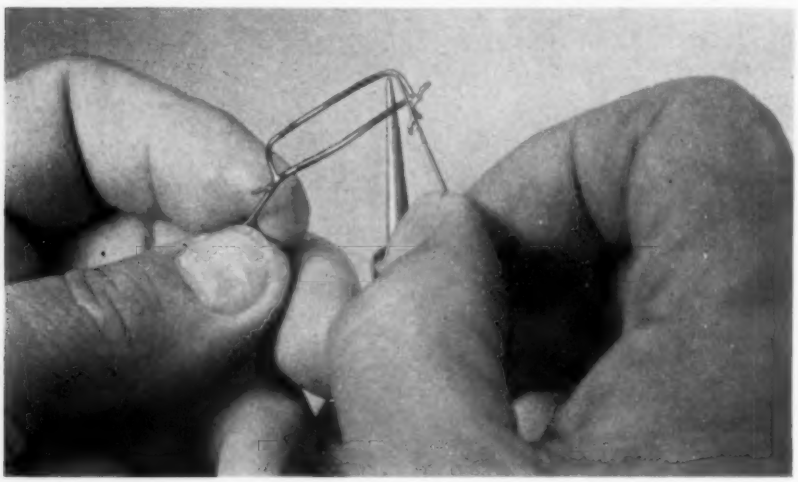


Fig. 20.—Attaching 0.022" wire for interlacing.

Twelfth, with both ends of the occlusal guide wire attached and satisfactorily completed to this point, the models with maxillary and mandibular lingual arches should be occluded in correct position and heat be applied to the occlusal guide wire until it becomes passive in its new relation.

Thirteenth, remove the maxillary lingual arch, with occlusal guide wire attached. In interlacing, use 0.022 wire and 14K solder. First attach one end

of 0.022 wire at base on the left side of the occlusal guide wire; then interlace up and down to the opposite side, spacing so as to have about 5 millimeters between each bend or point of attachment. After the wire has been bent to conform properly to the lingual arch and the occlusal guide wire, solder at each point of bend in the 0.022 wire.

Fourteenth, and the last step in construction to be described in interlacing, due to the application of heat, and to soldering off the model, the maxillary lingual arch may become distorted. To relieve this condition, replace the appliance on the model and heat treat until the appliance becomes passive in its relation to the maxillary lingual tubes.

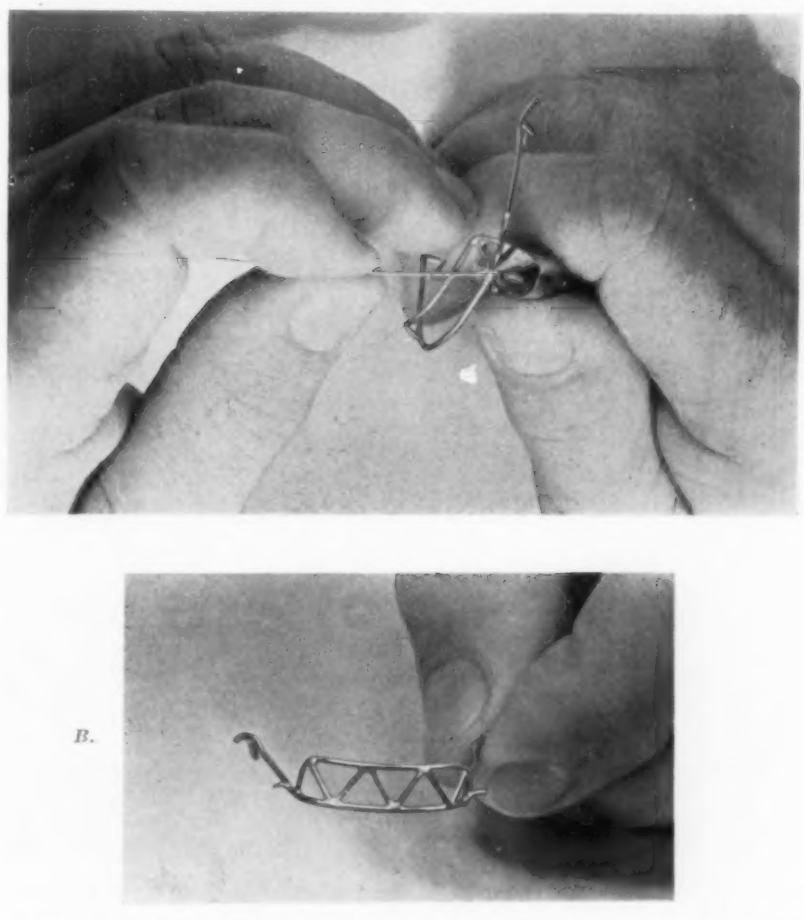


Fig. 21.—*A*, Interlacing from right to left side. *B*, Interlacing completed. Correct terminology is now "occlusal guide plane."

We need not dwell to any degree on the fact that we are here considering a mechanical device, for all present know that it is. We know that the dental device constructed has a plane—not just any kind of plane but a carefully established inclined plane. Such being the case, then what and why is this established plane? In forming it, as a part of the device, we create it so that the teeth will bear a certain definite relation to it; that is to say, both those contacting it directly and those not contacting it will be placed in a certain relation. Further, the wire which produces the established inclined plane causes a

change in the occlusal relation of the opposing posterior teeth, as well as a change in relation of the opposing anterior teeth, and it may or may not, according to requirements and construction thereto, cause a change anteroposteriorly with regard to immediate established relation of the mandibular to the maxillary teeth.

And, finally, when we have built such an appliance, nature, either of her own accord or in conjunction with movement by mechanical means through other components attached to the lingual appliance, causes teeth to move to their correct position.

Of course, as we have no doubt fully seen, if the occlusal guide plane is to fulfill the purposes for which it is intended, very definite procedures must be followed in outlining and constructing it. One cannot merely read the definition or a general description, and at once say, "Oh, I have it! I'll simply create a plane, add it to the appliance, having it do after a fashion what the definition states it should do." One must absorb well the definition, but study even more carefully the underlying basic facts and principles. Even a slavish following of the fourteen steps of construction here detailed will not create, unless supplemented by initiative and by insight, what a worthy dentist will want to achieve.

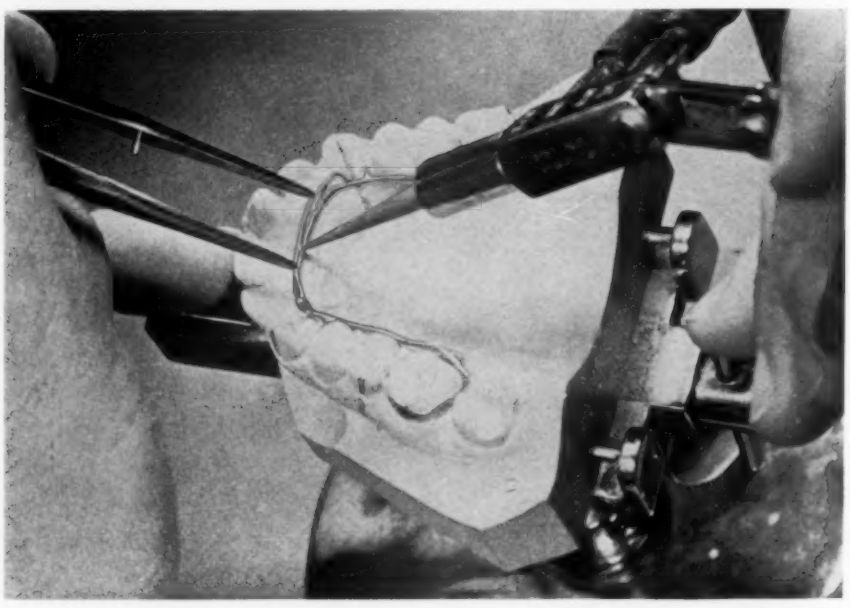


Fig. 22.—Applying heat to render occlusal guide plane and appliance passive.

The primary purpose for which the occlusal guide plane is used is to cause, by mechanical intervention, an immediate change in the relation of the maxillary to the mandibular teeth. The presence of the device in the mouth permits with absolute freedom our further intervention by mechanical means to cause changes of tooth position in the direction of normal relation.

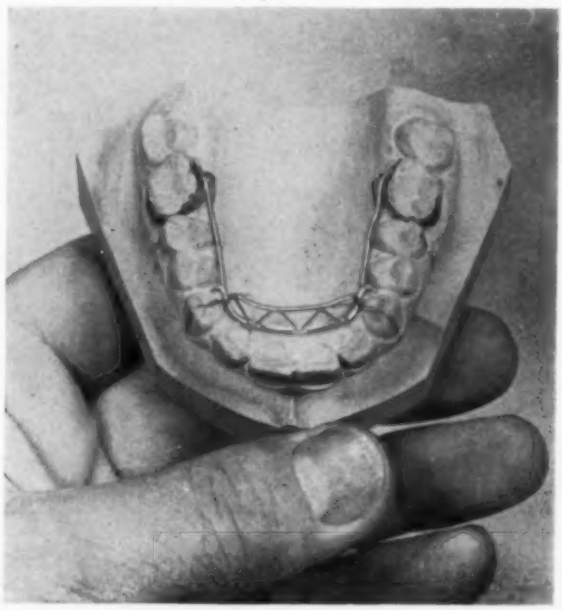
Also, the muscles of mastication are immediately stimulated in the direction of normal functioning.

In distoclusion the device causes a change in anteroposterior relation of the mandibular to the maxillary teeth. As a natural result, the muscles of the face, as well as of the tongue and lips, are brought into a more normal position.

Paramountly, more normal inspiration and expiration of air is brought about, because more normal lip relation is established.

In neutroclusion cases, where there is pronounced overbite of the anterior teeth, the occlusal guide plane produces an established occlusal plane, by causing occlusal separation of the posterior teeth. This permits lateral movement of

A.



B.

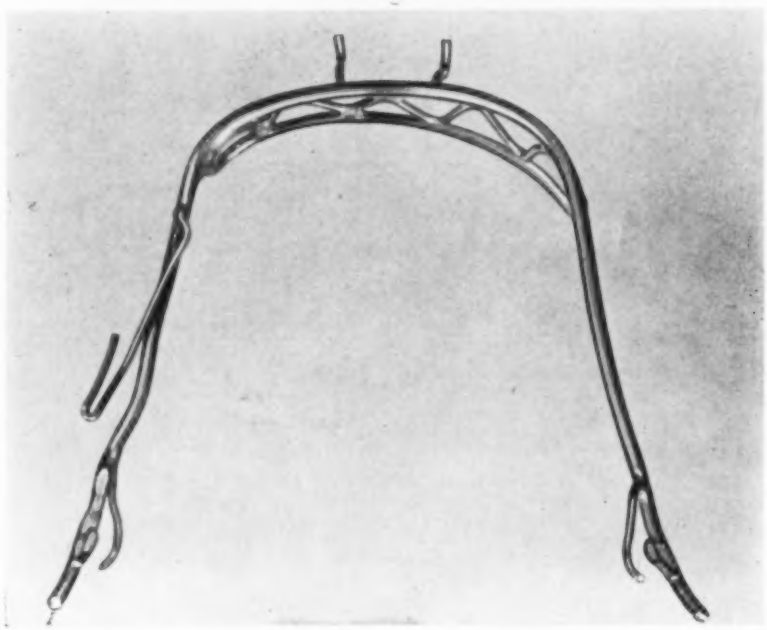


Fig. 23.—*A*, Completed occlusal guide plane. *B*, This figure shows the completed guide plane. Note the perpendicular auxiliary springs used to depress the central incisors.

the posterior teeth, vertical movement of them, and development of the associated tissue. In general we may say that the purpose of the apparatus is to

start immediately a change from improper to proper development of the forces of occlusion, which are generally accepted to be the following:

1. Normal cell metabolism.
2. Muscular pressure.
3. Forces of the inclined plane.
4. Normal approximal contact.
5. Harmony in the sizes of the arches.
6. Atmospheric pressure.

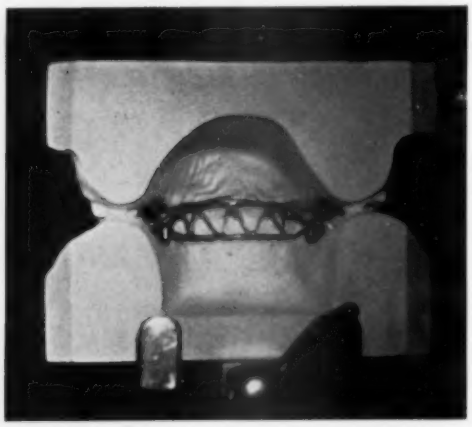


Fig. 24.—Posterior view of guide plane.

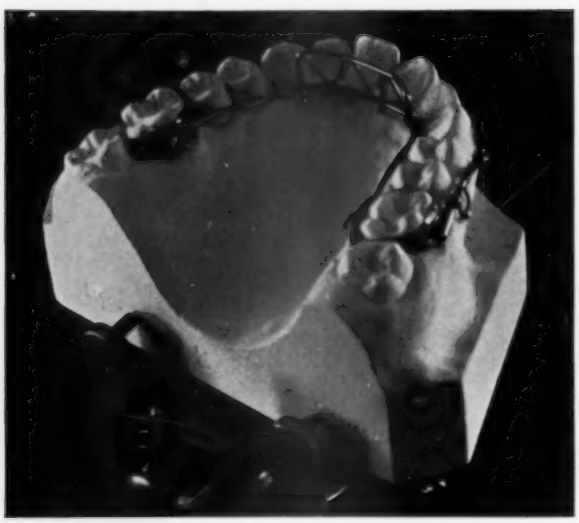
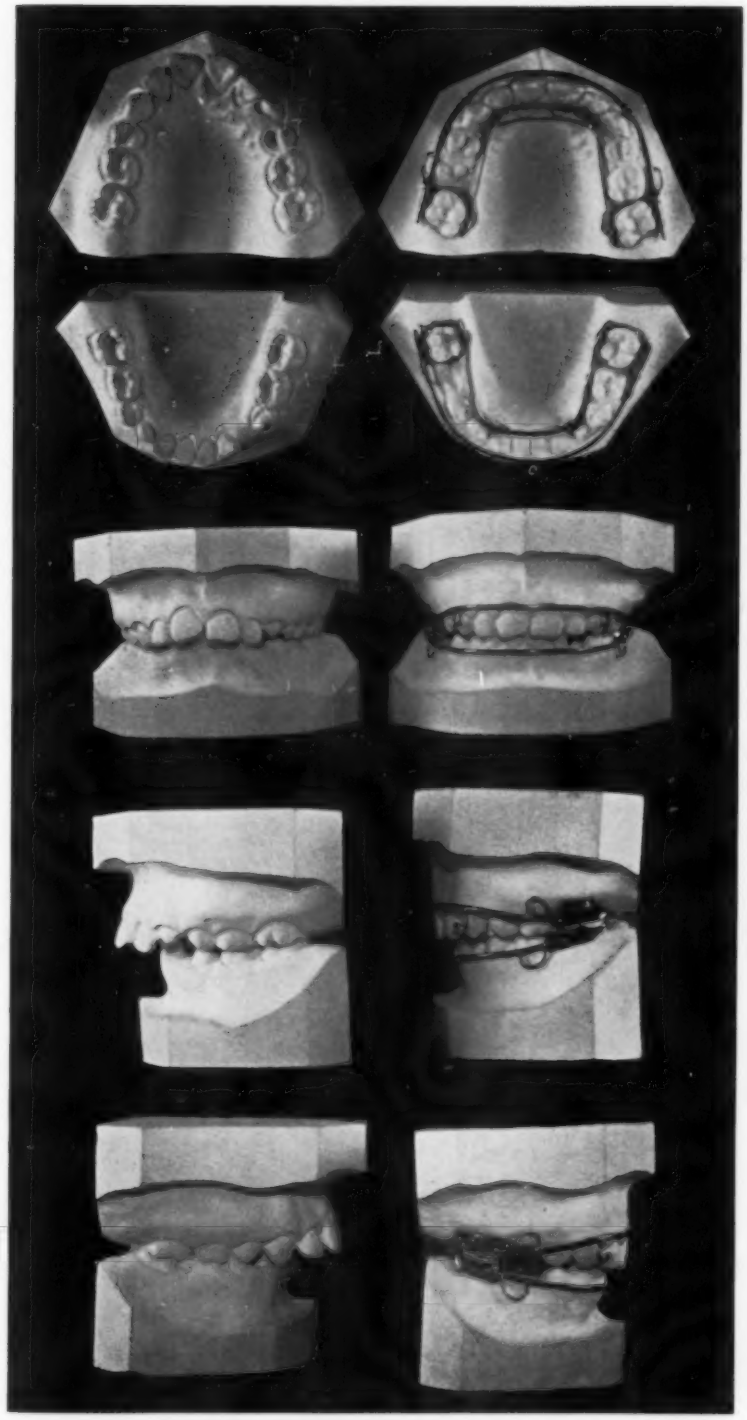


Fig. 25.—Occlusal view of guide plane.

Briefly the advantages* of the occlusal guide plane are as follows:

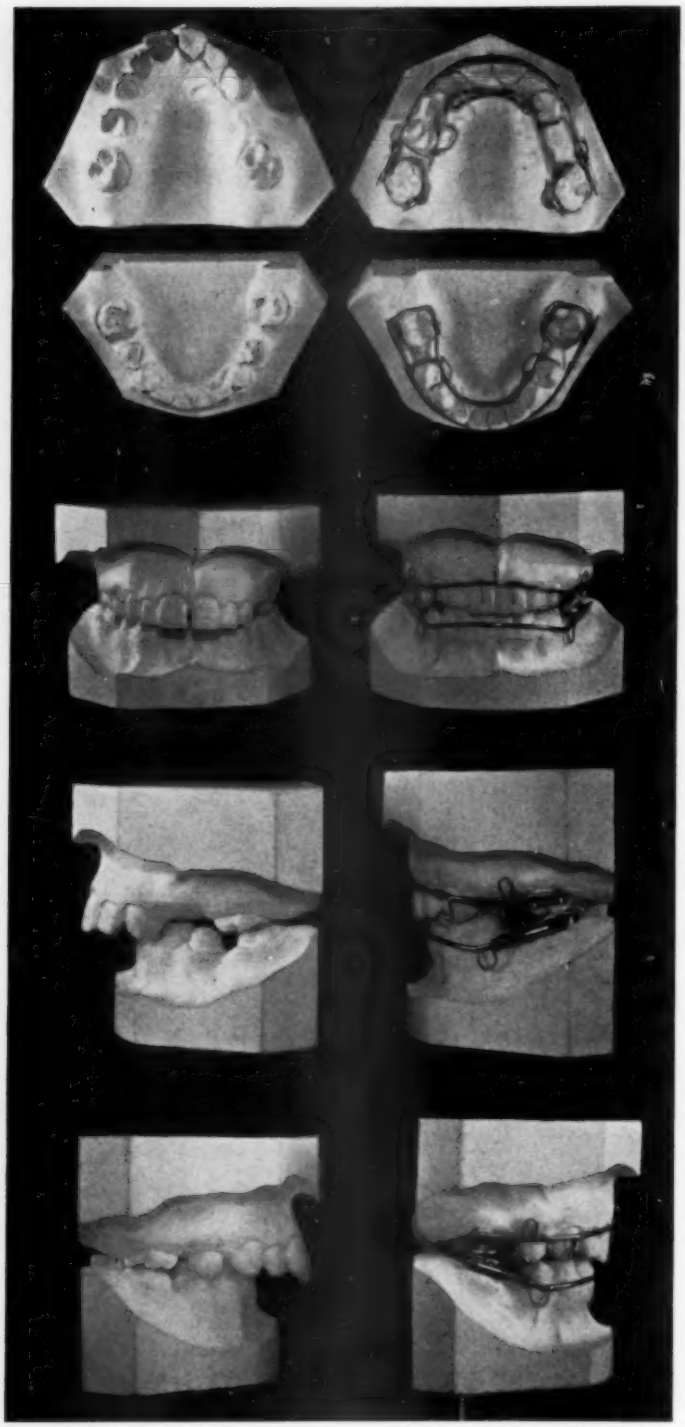
1. It is very efficient.
2. It requires no adjustment.
3. It is sanitary.
4. It does not cause traumatic disturbances.
5. It is not removable.
6. It accurately establishes anteroposterior relation of the arches and teeth.

*From Oliver, Irish, Wood: Labio-Lingual Technic, 1940, St. Louis, The C. V. Mosby Co., p. 288.



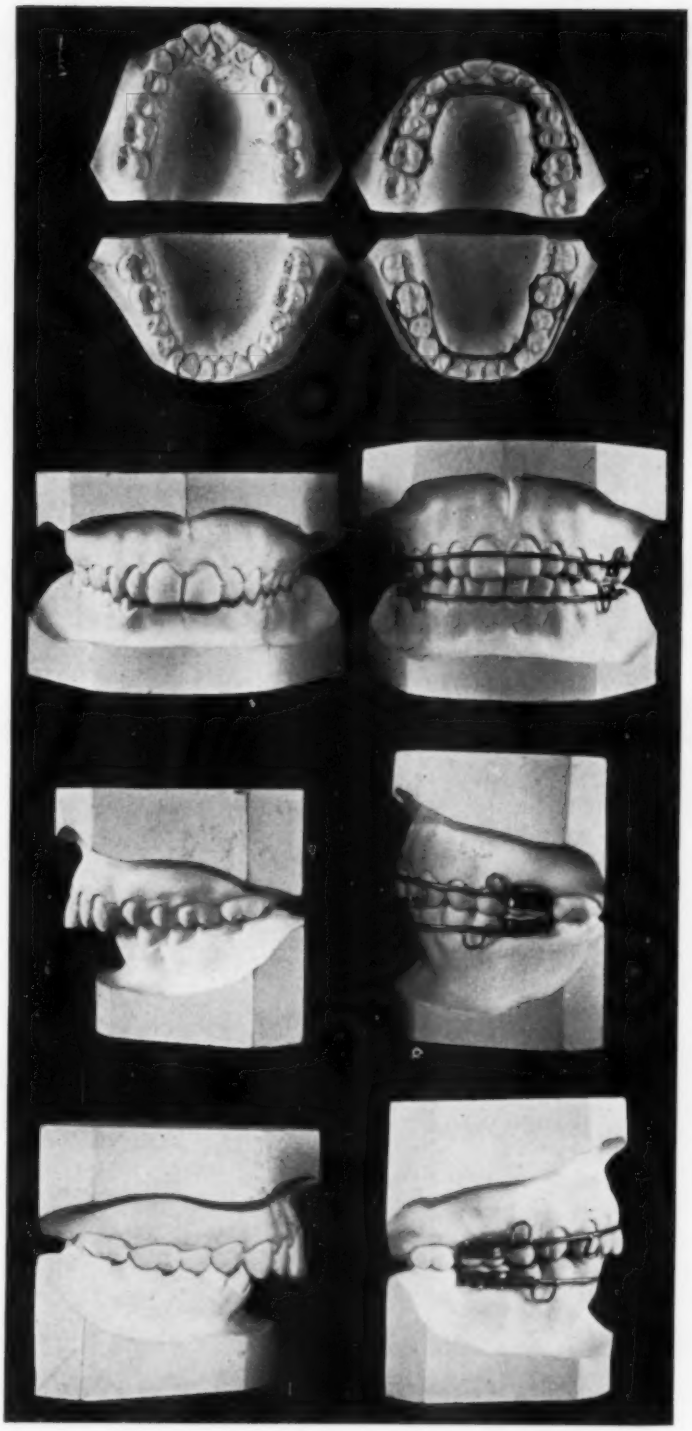
Case 1.—*A* shows occlusal view of the case before treatment and the type appliance used in treatment. *B* shows anterior view of case before treatment and the appliance used in the treatment. *C* shows the left side view of the case before treatment and the appliance used in treatment. *D* shows the right side view of the case before treatment and the appliance used in treatment.

The treatment of this case was begun on Nov. 16, 1940. The view with appliances on shows the results obtained on June 4, 1941, at which time appliances were changed and treatment continued.



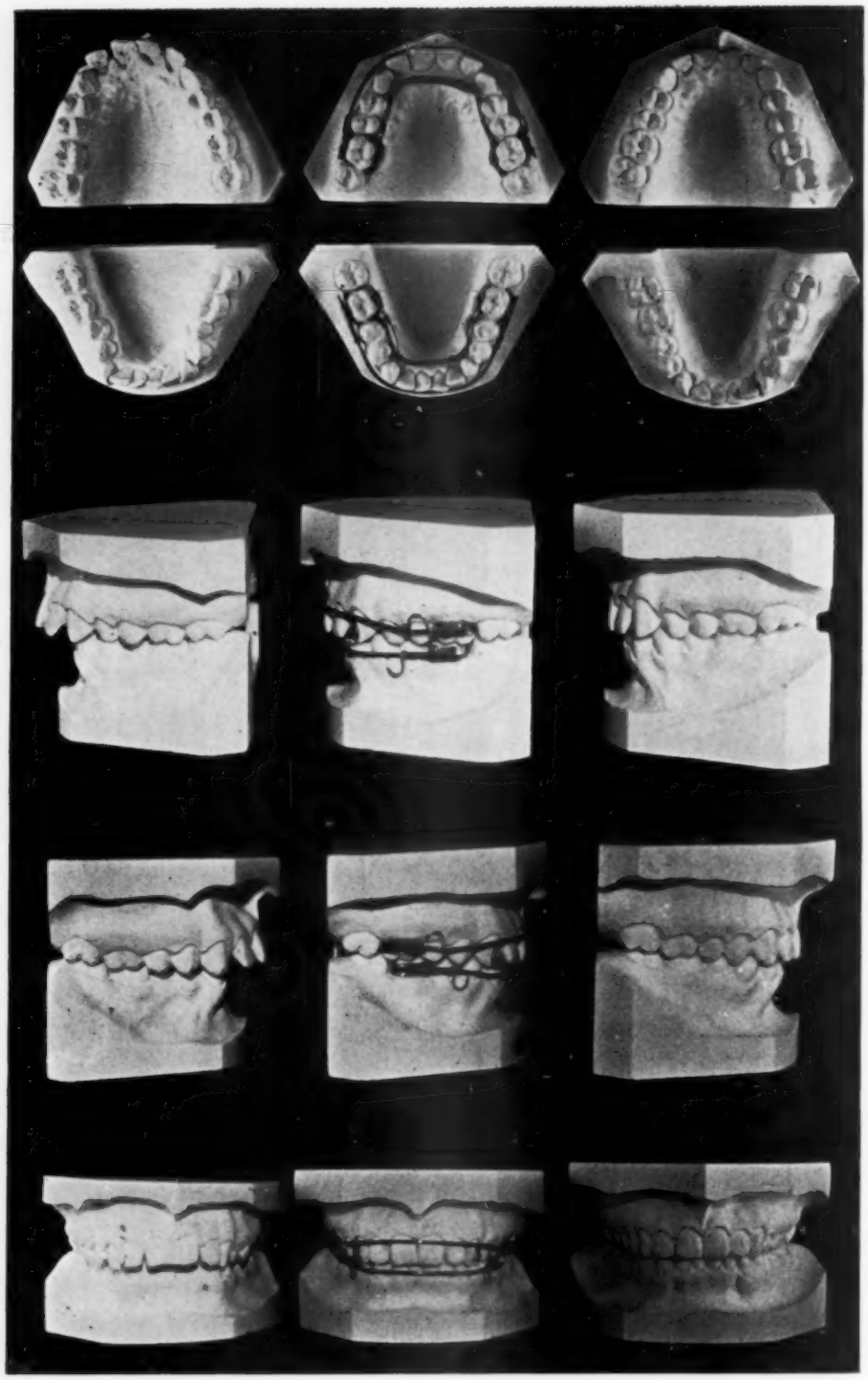
Case 2.—*A* shows occlusal view of the case before treatment and the type appliance used in treatment. *B* shows anterior view of case before treatment and the appliance used in treatment. *C* shows the left side view of the case before treatment and the appliance used in treatment. *D* shows the right side view of the case before treatment and the appliance used in treatment.

The treatment of this case was begun on Nov. 8, 1940. The view with appliances on shows the results obtained on May 31, 1941, at which time appliances were changed and treatment continued.



Case 3.—*A* shows occlusal view of the case before treatment and the type appliance used in treatment. *B* shows anterior view of case before treatment and the appliance used in the treatment. *C* shows the left side of the case before treatment and the appliance used in treatment. *D* shows the right side view of the case before treatment and the appliance used in treatment.

The treatment of this case was begun on July 20, 1940. The view with appliances on shows the results obtained on May 23, 1941, at which time appliances were changed and treatment continued.



Case 4.—*A*, view 1, shows the case before treatment was begun on June 26, 1939; view 2 shows appliance used in case which was removed Feb. 24, 1940; view 3 shows the completed case on June 26, 1941, which was sixteen months after all appliances had been removed. No type of retainer was used in this case. *B*, view 1, shows left side view of the case before treatment was begun; view 2 shows left side view of model with appliance used in case; view 3 shows the completed case sixteen months after all appliances had been removed. *C*, view 1, shows right side view of case before treatment was begun; view 2 shows right side view of model with appliance used in case; view 3 shows the completed case sixteen months after all appliances had been removed. *D*, view 1, shows anterior view of case before treatment was begun; view 2 shows anterior view of model with appliance used in case; view 3 shows anterior view of completed case sixteen months after all appliances had been removed.

The treatment of this case was begun on June 26, 1939. The view with appliances on shows the results obtained on Feb. 24, 1940. The third view shows the case sixteen months after all appliances had been removed. No further appliances or retainer was used in this case after Feb. 24, 1940.

7. It does not constantly engage the incisal edges, nor the surfaces of the lower anterior teeth.

8. It establishes a predetermined correct incisal and occlusal relation of the teeth.

9. It does not fracture.

10. It causes no physical disturbance to the patient.

11. It does not engage soft tissue.

12. Accurately and constantly, by its use, it stimulates muscular function, relation, and development.

13. It in no way prevents the addition of auxiliary attachments.

14. It does, contrary to the suppositions of some critics, permit normal speech and food ingestion.

15. It gives freedom of vertical growth of the posterior teeth.

Now what about disadvantages? Truthfully, the only disadvantages we have been able to find, in our own practice, have been not inherent, but only brought about, now and then, by our own negligence, and immediately and directly traceable to this.

The requirements* of the occlusal guide plane are thirteen in number. We list them as follows:

1. Must be made of 0.030″ precious metal wire.

2. Must have 0.022″ interlacing wire.

3. Must have correct pitch.

4. Must have correct depth.

5. Must conform in symmetry with the anterior segment of the appliance.

6. Must be attached exactly where the appliance is marked.

7. Must be interlaced so the interlacing is flush with the outer surface of the 0.030″ and 0.040″ wire.

8. Must have lower appliance clearance.

9. When completed, must be passive in relation to the appliance.

10. Must establish the desired anteroposterior relation of the teeth and arches when in position.

11. Must establish the desired and occlusal and incisal planes.

12. Must make possible freedom for vertical growth of the posterior teeth.

13. Must make possible axial change of the anterior teeth.

Compliance with the enumeration just mentioned is essential; failure will result if there is deviation from this.

The illustrations give further details in our discussion of the appliance and the technique.

I hope that each of you will gain the happiness, satisfaction, and appreciation that have been mine as you yourselves employ in your practice the occlusal guide plane.

1101 Medical Arts Building

*From Labio-Lingual Technic, p. 289.

REPORT OF THE RESEARCH COMMITTEE

Owing to a misunderstanding over the personnel of the Research Committee, which misunderstanding has been settled only recently, the usual survey of research efforts has not been made during the past year. In an effort at an analysis, however, a review was made of the work of previous committees as these are set forth in the published transactions of the Association. The result has been rather interesting.

At the meeting in St. Louis in April of 1936, Dr. Hellman as Chairman called attention to the research work of Albin Oppenheim on biologic treatment, of Broadbent and others on growth and development, of Stanton on occlusion, etc. He also pointed out that certain recommendations had previously been made to the New York Society of Orthodontists, and he offered these for action to the American Association of Orthodontists.

1. That a fund be established by the A. A. O. to provide for a special course of lectures to be delivered each year at a different university on the most recent and significant advances in orthodontics.
2. That this Association cooperate in the establishment of at least one free scholarship in orthodontics.
3. That the Association offer a yearly prize, to be awarded for the most outstanding contribution on any practical or scientific subject related to orthodontics.
4. That the Association set in motion a movement for the establishment of a museum in which some of the priceless collection of casts, orthodontic instruments and appliances might be preserved for posterity.

At the meeting in Chicago in April of 1937 there was apparently no report of a Research Committee.

At the meeting in Hollywood, Calif., July of 1938, Dr. George Moore as Chairman announced that he had followed the instructions of the new constitution and by-laws and submitted a list of seventy separate and distinct projects being carried on by various institutions and individuals. This list he had obtained by sending questionnaires to the various schools and departments.

At the meeting in Kansas City, Mo., in 1939, Dr. Moore again made the report. He had followed the same plan as that of the previous year and was then able to submit a list of 117 items. In addition to this listing, the committee offered a resolution that a cash prize of $200.00 be offered by the Association to that member who, in the year prior to its annual meeting, had submitted to the Research Committee the most outstanding unpublished essay based on original investigation. The committee was to decide whether the award was justified. This report was accepted and that part which referred to the expenditure of funds was referred to the Budget Committee.

At the meeting in 1940 there was no report from the Research Committee, and the 1941 transactions are not at hand at the time of the preparation of this report.

Comment

The listing of over 100 research projects by members or associates of a society of this size would seem to indicate that the membership was acutely aware of the value of scientific investigations. A critical analysis, however, casts doubt upon this assumption. In the first place, many of the projects listed could not properly be called scientific research. In the second place, very few have ever gone beyond the paper stage, if we are to judge by the number that have attained the point of presentation and publication three or four years later. Finally, the Association has never considered any of the proposals offered by the Research Committee relating to the establishment of scholarships, lectureships, or prize awards. Yet, on two separate occasions during the same period of time, it has voted $2,500.00 to the Public Relations Committee for what must be considered orthodontic publicity.

From the turn of the century until approximately twenty years ago the orthodontist was the chief contributor to dental research. Much of modern dental practice, not to mention general biologic science, is based on the labors of these men. At the 1941 meeting of the International Association for Dental Research, out of the 110 papers and reports made there were but five by orthodontists, most of whom were teachers. This is an alarming slump.

To the man engaged in the practice of any profession, research may seem to be a thing apart, something which does not concern him. Medicine, however, has already realized, and dentistry is rapidly becoming conscious of the fact, that the research of today becomes the teaching and practice of tomorrow. Any art, any science, indeed, any industry that has lost its interest in unexplored fields and is content with what it already knows is doomed.

Your committee would like to point out that while industry and medicine are attracting and diverting huge sums into aggressive research programs, dentistry has not been able to attract anything but meager support except in the case of two or three institutions. Orthodontics has yet to attract a single large gift. The majority of investigators in our field are laboring at the expense of either office or teaching time and at considerable sacrifice to themselves.

The American Association of Orthodontists represents American orthodontics, and American orthodontics has always led the world. But unless the society becomes alert to the necessity of supporting research by its interest at least, it can hardly expect support from outside sources, nor can it expect world leadership to remain in this country. Our military invincibility is not the only matter in which we have become smug.

Your committee does not urge that you begin a program of research underwriting, however. Quite to the contrary, it feels that such subsidized research is frequently unfortunate. It does urge that you institute a program to foster and encourage those who show ability along these lines. By way of specific suggestions it makes two recommendations.

The first suggestion is that the American Association of Orthodontists immediately establish one, or a series of prizes, to be awarded annually for outstanding research work in orthodontics or in a field related thereto. Your committee felt that it would prefer that the Board of Directors decide the amount and number of prizes to be offered and also consider the matter of eligibility. In order to offer some basis for discussion the committee suggests that if only one prize is to be offered it should go to a man young in orthodontics. His work might represent his thesis as a student of orthodontics or work done subsequently, but it should in nowise be given for work done after he has completed his formal orthodontic training by a period of more than two years.

If more than one prize is to be offered, another might be open to members of the specialty at large or to anyone in an allied field. Membership in the American Association of Orthodontists should not be a prerequisite. And finally, that no prize need be awarded if, in the opinion of the committee, no piece of work justified it.

The second recommendation of your committee is that since orthodontic investigators as a group have no organization, it would be to their advantage and to the advantage of the society as a whole if they were given a definite amount of time on the annual program. The meetings of this society would probably bring a greater number of such men together and permit of a freer exchange of ideas than any other. This could be handled either by turning over a specified amount of time from the general program or by assigning time and quarters that would permit this group to meet—perhaps while clinics were being given. The content and arrangement of their program would be a function of the Research Committee.

In closing, your committee earnestly petitions that some action be taken on these matters, for it feels that the recommendations herein contained constitute a safe though minimum program that has for its object the encouragement of orthodontic research.

VERNON FISK '42
MILO HELLMAN '43
ALLAN G. BRODIE '44, Chairman

Editorials

Teeth and Malnutrition

Too much of the nutritive elements needed in the body may be as harmful as too little. All through nature it is the perfect balance that produces the perfect bone or tooth tissue. Fluorine, for instance, is essential for the enamel of the teeth—too little of it and the enamel does not form perfectly; too much of it and unsightly discoloration is the result.

The information revealed in the examination for the draft has focused attention sharply on nutrition as it is related to teeth and much attention is now being given this subject by nutrition experts.

The science of nutrition obviously has been one of the outstanding contributions to medicine in the last two decades. Many persistent diseases that for centuries baffled physicians can now be corrected by diet supervision alone, and that is important to orthodontists.

If you happen to be one who is unable to become concerned about the rather important relationship that may exist between proper food, sunlight, and nutrition in general to the complete and ultimate position of the occlusion of teeth, you should consistently read one of the several modern medical periodicals that is devoted to the specialty of pediatrics. Here may be found, from time to time, the current reports of eminent nutrition experts and growth specialists who devote their lives to the supervision and the checking of the growth grids of children from birth to adolescence. By following these reports, several impressions will be quickly formed: First, that malnutrition in childhood is far more prevalent and highly detrimental to normal child growth than is generally realized. Second, that when the dentist observes a child whom he knows, from general appearances, is suffering from some form of malnutrition and he immediately prescribes orange juice and calcium, he probably is not doing his patient any harm, but in like manner he probably will do him no good. The more you read of what is known about modern nutrition, the more it is realized that for the dentist to prescribe for this condition is largely a case of the blind leading the blind. The subject is now so broad and scientific that so-called "shotgun" prescriptions mean nothing.

Unsupervised diets, poor preparation and selection of foods, inadequate milk intake, repeated infections, allergy, general hygiene neglect, and dental defects of various kinds are the things that modern experts are watching in children in a precision-like way. The general symptoms show a physically exhausted, tired, wan child, with loss of fat tissue, especially in the neck, chest, and thighs. These are the principal symptoms, in addition to what is regarded as the important evidence that is revealed in the mouth and the condition of the teeth and jaws.

Malnutrition is rampant in children and is of great concern among the experts, in spite of the great advance in knowledge and the improvement in general health, particularly in growth development of present-day childhood as

compared with conditions a generation ago. Once a child has deviated from the normal pattern, his course seems to be much like that of a ship at sea. To get him back on the normal and direct course requires the diagnosis and care of those who thoroughly understand the science of nutrition. Orthodontists are becoming more and more nutrition conscious, as is evidenced by their increasing resistance to the correction of malocclusion in children physically below par. They are finding through clinical experience alone that orthodontic treatment for such children carries a higher risk element than it does for children in radiant health.

In January, a program of great importance was launched in Canada by the Canadian Council on Nutrition. The program is to last throughout this year and deals with the eating habits of all the people, particularly those in war industry. It is designed to educate Canadians in the proper use of available foods; first, to improve public health; second, to make possible a great war effort; and third, to prepare for a stronger and a healthier people. It would seem that it is not too fantastic to predict that textbooks on the subject of orthodontics in the future will have more to say about the etiology and prognosis of malocclusion, as it is related to nutrition. Before that happens, however, it is plain that more investigation and research will be done on this subject. It is a timely one, and no doubt much will be learned if the current theme of nutritional experts as related to the teeth can be taken as a criterion. If there is anything to the adage that important events cast their shadows before them, the shadow of today is malnutrition from infancy and what it does to teeth and the dental arch.

H. C. P.

American Association of Orthodontists Meeting Cancelled

The annual meeting of the American Association of Orthodontists, which was to have been held in Chicago in May, has been cancelled on account of the dislocation of the times and in order to cooperate with the government of the United States in its request that all meetings that require transportation and hotel facilities be cancelled during the present emergency.

In order that the officers of the Association might have the reactions of the members on this subject a poll was taken by mail, as the constitution provides for such a contingency. The poll revealed that the vast majority of the members are in favor of postponing the meeting.

At a meeting of the Ad Interim Committee, called by President J. A. Burrill in Chicago at the time of the Chicago Dental Society meeting, it was announced that the American Association of Orthodontists now has a membership of 687 and that 25 new members were added to the list during the past year.

With the spirit of cooperation, so characteristic of the members of the A.A.O., they have met the real emergency. It may be assured, however, that no meeting will ever be cancelled for reasons less serious. It has often been said that the A.A.O. is one of the most vigorous and enthusiastic, certainly one of the most fraternal, groups in the dental profession and the cancellation of its annual meeting is a real disappointment to many, unavoidable nonetheless at this time.

H. C. P.

Department of Orthodontic Abstracts and Reviews

Edited by

DR. J. A. SALZMANN, NEW YORK CITY

All communications concerning further information about abstracted material and the acceptance of articles or books for consideration in this department should be addressed to Dr. J. A. Salzmann, 654 Madison Avenue, New York City.

Round Table Discussion on Orthodontics. Chairman: Alfred Paul Rogers, D.D.S. Associates: Allan G. Brodie, Ph.D., D.D.S., and Charles M. Waldo, D.D.S., *J. Pediatrics* **21**: 551-564, Oct., 1942.

Opening Remarks, Alfred P. Rogers, Boston.—We are concerned with the development and function of living machinery, and in that our practice is essentially orthopedic in nature. It is true that a refined mechanics must be employed in the treatment of many dental anomalies. Such mechanical treatment can be looked upon as merely symptom treatment. Being of a corrective nature, it is, of course, extremely important. In recent years we have been looking deeper into the problems of growth and development and have found it necessary to become active students of the basic biologic sciences in seeking a better understanding of the etiologic factors which underlie dentofacial anomalies.

One of our great hopes lies with those who are trained and situated as you are to see children early in life and thereby recognize the early stage of developing dentofacial anomalies.

We should consider the following problems relative to daily practice:

1. Cooperation between the pediatrician and the orthodontist.
2. Those complex emotional conflicts between the mother and child in reference to habits having a tendency to promote oral deformities.
3. The influence of mouth breathing over prolonged periods when seen to interfere with the proper development of the dental arches.
4. Treatment that is necessary in cases of partial anodontia.
5. A consideration of the variability of length of time for periodic orthodonties.
6. Jaw deformities due to birth injuries.
7. Subluxation of the mandible in infants (mandibular dysplasia).
8. The relative importance of orthodontic treatment in relation to other necessities of life—an economic problem.
9. Importance of malocclusion to the child, both physically and emotionally.
10. The nervous reactions in childhood due to orthodontic treatment and how best to avoid them.
11. The type of child deemed by pediatricians as too nervous or physically unfit to undergo orthodontic treatment.
12. Differentiate the acquired types from those due to congenital abnormalities.

13. The age as which the orthodontists should see the patient and what determines the age when treatment should be undertaken.

14. What the pediatrician can do to help the infant and young child before appliances can be adjusted.

15. Malnutrition as a basic factor in dentofacial anomalies.

The Nature of the Orthodontic Problem, Allan G. Brodie, Chicago.—The dental apparatus of man, like other parts of his economy, comes to a full normal maturity only as a result of the normal operation of hereditary, congenital, and environmental factors.

Experimental embryology, employing irritants, and transplants, has proved beyond any reasonable doubt that the form of bones is genetically determined.

More important from our standpoint is the discovery, or realization perhaps, that growth centers do not appear simultaneously but in orderly sequence that covers a long period of time. Very little is known at the present in regard to either the time or sequence, except in the case of the teeth and some of the bones. The close study of the former by Schour and his co-workers, however, has yielded certain findings that are of equal importance and may, indeed, furnish the key to this problem. Briefly, these findings are as follows:

Growth centers exhibit their highest rate of activity at the instant of their appearance and gradually diminish as the age of their cells advances. Probably no two centers have the same rate and gradient. Nor do all centers have the same span of development. These differences in time, rate, and locus operate to transform the embryo from a disclike structure into the easily recognized fetus of three months. This largely completes the phase of disproportionate growth or morphogenesis. Body form has been established and development from there on is a matter of varying rates of appositional growth. Such rates, however, are so integrated that changes in proportion are held to a minimum.

Scammon and Calkins, in a study of a large mass of fetal material, concluded that growth of the body was strictly proportional from the third month on. The author, working on living children from the third on to the eighth year of postnatal life, found exactly the same type of growth.

Strangely enough, the deformed head exhibits the same orderly progress and the same stability of relations. One can only conclude that the incremental growth is proceeding normally but on a pattern that has been distorted during the stage of morphogenesis.

Growth centers in the teeth, like those in the bony skeleton, appear at different times. Furthermore, their incremental growth proceeds at different rates. Since the time of appearance of centers has been adequately studied, it is now possible to date the onset of a disturbing factor by noting the teeth that are affected. Thus, markings on the tips of the cusps of the first permanent molars indicate a disturbance at birth or shortly after. Edges of central incisors and tips of canines reflect adverse factors operating during the first three postnatal months. The lateral incisors do not begin to form until approximately the first year and hence would not be affected by factors operating before that time. The important point to be made here is that only those

centers that are active at the time of operation of the disturbance are affected. These are distorted or arrested, but those that appear later are not influenced in any way. When recovery occurs, growth proceeds in a perfectly normal manner, albeit perhaps on a distorted pattern, but the working time that has been lost by the cells is never made up. Sarnat has recently pointed out that this probably explains why only central incisors and first permanent molars exhibit the Hutchinson pattern of early congenital syphilis.

In a general way we may say that disturbances in cranial growth, and particularly of the anterior portion of the base, occur very early. Since this area is the foundation upon which the upper face is reared, we would expect associated distortions here, particularly in the upper nasal area. Posterior cranial growth and the growth of the entire face may be affected beginning at birth, as in some forms of cretinism. The cretin, in fact, furnishes us with some very conclusive data on our problem. At birth the infant may be normal in development, but upon being shut off from the hormone of the mother suffers a uniform, and almost complete, retardation of growth. Obviously, those parts that are closest to their full development, like the anterior cranial fossa, will suffer least, while those parts that still have considerable growth expectancy will suffer the most. Untreated, the cretin remains infantile in pattern; treated, he presents a picture that will tell how long his deficiency lasted.

Factors influencing the mandible would occur at a relatively late date, and the growth center at the condyle of this bone is particularly vulnerable to localized environmental disturbances.

And finally we come to the most frequently occurring deformity found in modern man; that is, malocclusion of the teeth. On the basis of what has been said, this high incidence in one particular area might seem contradictory were it not for the fact that we are dealing with dissimilar structures. The teeth are laid down at a relatively early date in postnatal life and are not subject to any subsequent alteration. The jaw bones which are to hold them, however, do not fulfill their growth before the eighteenth to the twentieth year. Furthermore, the precise nature of the relationships that must exist between teeth if they are to occlude normally magnifies any discrepancy between teeth and jaws to far beyond the significance it would have elsewhere. A man whose legs have failed by an inch to attain their full length goes unnoticed, but one whose jaws fail by an eighth of an inch is a dental monstrosity.

From what has been said it should be apparent that the orthodontic problem embraces more than thumb-sucking, sleeping on the fist, or breathing through the mouth. While these factors are very influential in altering the form of the occlusion of the teeth, they do not constitute more than a fraction of the etiologic factors with which we must reckon. Eliminating all consideration of hereditary influences, about which we are in almost total ignorance, we are faced with the challenge of preventing congenital mishaps and of keeping children well during their growing period. This means a striving for perfect health of the mother during pregnancy, an uneventful neonatal period, and a healthy, robust childhood. These latter problems the orthodontist must leave to the pediatrician.

Synopsis of Orthodontic Problems, Charles M. Waldo, Boston.—Our real problems are not those of mechanical treatment but those incident to the de-

cisions which must be made before treatment is started or planned. The basic concept of what is right or "normal" will largely determine other concepts fundamental to the whole structure of clinical practice.

The concept of "normal" as a fixed, clear-cut ideal is an excellent basis for classification of malocclusion, but it does not materially help us to decide the needs of a particular patient.

Research groups have pointed out repeatedly: (1) that individuals differ in almost every attribute and characteristic studied, that the range of such variation is often wide, and, what is most important, that even wide variations may be entirely consistent with health; (2) that repeated examinations of the same individual, particularly if he is growing, aid greatly in determining how he differs from other individuals, what his inherent patterns, trends, and tendencies may be, and what should be considered "normal" for him; (3) that genetic factors and potentialities undoubtedly play an important role in determining not only what an individual is but how he reacts to his environment; (4) that consideration of the whole individual organism is necessary in evaluating either health or a departure from it.

Our real concern is not so much in giving each patient a perfect denture as in giving him one that will neither interfere with his physical well-being nor worry him because of his appearance.

Just where to draw the line in deciding whether any set of conditions is of such severity as to indicate treatment is a question which will always depend upon clinical judgment. An arrangement of the teeth which might seriously affect the physical well-being of one patient might be well tolerated by another whose general health is better or whose will to overcome handicaps is greater.

For purposes of illustration, handicaps (of orthodontic interest) might be grouped as follows:

A. Handicaps to physical well-being.

1. Conditions which seriously interfere with the mastication of food; examples—deformities in which only a few teeth come into occlusion seriously limiting function.

2. Conditions which seriously interfere with the health of the teeth themselves, their supporting structures, or the soft tissues adjacent to them.

3. Conditions in which the mechanical relation of the opposing teeth tends to restrict or pervert facial growth. Examples: cases in which all the lower teeth bite entirely inside the upper teeth, and those in which lower incisor teeth bite outside of or in front of the upper incisor teeth.

B. Handicaps to mental well-being.

1. Handicaps in which dental factors are predominant. (These would consist of definite deformities which obviously detract from the patient's appearance.)

2. Handicaps in which psychologic factors are predominant. (These would consist of minor deformities or irregularities which are of concern to the patient himself but do not obviously detract from his appearance.)

The answer to our questions must depend upon a knowledge of the particular patient, his needs, his biologic assets and liabilities, and a careful weighing of values.

Discussion

Q. Does giving cod-liver oil in pregnancy affect calcification of the deciduous and permanent teeth? If so, what is the optimum dose and is a concentrate preferable? How long in years should cod-liver oil be given to affect the temporary and permanent teeth?

A. (Brodie.) Yes. The deciduous teeth have begun to grow, although usually are not erupted at birth. Calcification of permanent teeth is affected more by cod-liver oil given the child. This is usually complete by the eighth year.

Q. At what age does the dentist stop thumb-sucking?

A. (Waldo.) If it persists after the age of three or four, special attention should be given to it. Direction of the child's attention to other activities, removal of sources of irritation, and evidence of fatigue and excitement are important. Mechanical restraints are not desirable but may be necessary if other means are not successful.

Q. Does eruption of teeth cause thumb-sucking?

A. (Rogers.) It may be a contributing factor, but the habit usually starts before this time. It is better for the dentist or physician than the parents to direct correction of the habit. Tongue-biting and lip-sucking are often substituted when the thumb-sucking habit is broken. Such habits are very persistent and require careful correction.

Q. I have a patient 4 years of age with closely set teeth but with otherwise good occlusion. One dentist advised extraction of some of the teeth. Should this be done?

A. (Waldo.) No, there is reason to believe that the jaws will grow.

Q. For wide spacing of teeth should soft tissue be removed?

A. (Rogers.) This is a controversial question. It is better to be conservative unless bone is interposed, in which case it should be removed. In my experience about 75 per cent prove to be self-correcting.

A. (Brodie.) Excess spacing between central incisors gradually closes as lateral and canine teeth erupt.

Q. What is the effect of orthodontics on the hard palate and nasal space?

A. (Brodie.) There is no effect on the hard palate or nasal space. The effect does not go beyond the bone surrounding the roots of the teeth involved.

Q. What would you recommend for congenital hypoplasia of the mandible?

A. (Rogers.) In one case about which I was consulted a cloth helmet, of skull-cap variety, with attachments was made to serve as a support for the mandible. This apparatus appeared to be quite effective.

Q. To whom should the patient needing orthodontic treatment be referred, to the general dentist first or to the orthodontist directly?

A. (Rogers.) You should be governed concerning this as you would in referring a patient to a specialist such as the orthopedic surgeon or the pediatrician, according to conditions present. There is still a great lack of appreciation of orthodontics by general dentists.

Comment.—The child should be considered as a whole, including his family and race. Where there is an orthodontic problem, the ossification centers should be studied, especially those of the skull. This may lead to endocrine therapy.

Mechanical factors, such as lying on the hand, or having the bottle too long, play a part in the production of deformities of the jaws. Greater success can be obtained by closer cooperation between the orthodontist and the pediatrician.

Q. Dr. Brodie, if, as you show, that at 2 years of age the teeth are fixed in the jaw, not being subject to any subsequent alteration, and the jaws continue to grow until the eighteenth to the twentieth year, will attempted orthodontic treatment tend to throw this relationship out of line in an unfavorable manner?

A. (Brodie.) No, if the correction is made early it may prove beneficial. The longer correction is put off the less apt you are to get improvement. However, early jaw deformity frequently cannot be recognized except by x-ray.

Comment.—It was interesting to hear the discussion about the effect of prenatal diet on the development of the teeth in the offspring. In Cincinnati, Drs. T. K. Selkirk, A. Graeme Mitchell and J. V. Greenbaum studied the effect of diet during pregnancy on the offspring for such conditions as rickets, the development of the teeth, the nutrition, the bony development, and the like. These observations on the same children were presented before the American Medical Association and the American Dental Association in 1926 and 1930, respectively. We were astonished at the time to note the splendid condition of the teeth and the dental arches in this group of children who were chiefly of the colored race. Even though there were varying degrees of rickets present in infancy, none of these children later in life needed any orthodontic treatment.

A. (Waldo.) Both of these seem to be common findings; i.e., lack of positive correlation between rickets and malocclusion, and a low incidence of malocclusion in Negroes. The latter may be due both to strongly expressed racial characteristics and to a relatively pure racial background.

A. (Brodie.) We have made the same observation on numerous colored children. However, it should be pointed out that the incidence of malocclusion is lower in the colored race than in the white.

Q. Where teeth have been knocked out, how early can space retainers be used?

A. (Brodie.) It depends upon the area involved. Ordinarily no space retainers are necessary in the upper incisor areas, which are usually the site of the injury.

Q. What do you think of advertisements advising chewing gum for children?

A. (Brodie.) Chewing gum is apt to make the deformity worse if this is on a local basis.

A. (Rogers.) When practiced during certain periods of development, it may tend to exaggerate the tendency toward distoclusion. In children wearing delicately adjusted apparatus, it may sometimes interfere with the appliances by bending or loosening the attachments.

Q. At what age should orthodontic treatment be started?

A. (Brodie.) There is no definite age. It varies with the individual and the type of case, anywhere from 2 to 45 years.

Q. Will some appliance behind the teeth stop the habit of the protruding tongue?

A. (Rogers.) It will, but I believe that a more helpful way is by teaching the child constructive tongue exercises.

Q. Is it true that it is becoming the custom to postpone correction and to shorten the length of time that appliances are used?

A. (Rogers.) Yes, in answer to your second question, we do try to shorten the time that we use appliances, but the correction of the abnormal condition should begin as soon as constructive work can be started.

Q. It has occurred to me that some orthodontic problems might be avoided or corrected by the proper use of the muscles of the face, such as correcting faulty habits of chewing and mastication, and teaching the proper use of the tongue and lips in overcoming faulty or lazy habits of speech. Can something be done along this line?

A. (Rogers.) There is much that can be done by establishing the correct use of facial muscles. In a word, normal function of the muscles of the face tends toward general satisfactory development of the dental apparatus.

Q. What is the frequency of orthodontic defects?

A. (Brodie.) There are no satisfactory statistics on this question, largely because malocclusions vary to such a degree that investigators cannot agree on what constitutes a real defect. I think that it would be safe to say 50 per cent of the white population are afflicted.

A. (Rogers.) If we include slight malocclusion, the frequency of orthodontic defects would, of course, be very high. I should think more than 70 per cent would show these defects. However, we would find a very small percentage when we consider dental deformities that would classify children as dental cripples.

Q. What should be done with persistent deciduous teeth?

A. (Brodie.) Leave them alone unless cavities or ankyloses are present. In considering the eruption of teeth, the physiologic rather than the chronologic age is important.

Q. How should supernumerary teeth be handled?

A. (Waldo.) Removal without damage to other teeth. Sometimes when adjacent teeth are congenitally absent, supernumerary teeth may be utilized. This possibility should be considered before their removal.

Q. Should deciduous teeth be removed if they persist after eruption of permanent teeth?

A. (Brodie.) They should be removed.

Comment.—Some orthodontists advise removal of sound teeth to aid in orthodontics, and the pediatrician is asked for advice.

A. (Waldo.) The removal of sound teeth can be used as a very definite aid in the treatment of some types of malocclusion, but it should always be part of a carefully thought-out program and should be used with caution. In the treatment of malocclusion, this is often one of the most difficult decisions to make and one most likely to depend upon the individual nature of the case at hand. An opinion which considered the competence and judgment of the orthodontist in question would seem to be the best advice the pediatrician could give in most of these cases.

Q. If deciduous teeth are so carious that they must be extracted, are there indications which call for orthodontic treatment to prevent drifting?

A. (Rogers.) Large spaces should be filled to prevent drifting.

News and Notes

American Association of Orthodontists Meeting Cancelled

The meeting of the American Association of Orthodontists, which was to have been held in May, 1943, has been cancelled.

MAX E. ERNST, Secretary
American Association of Orthodontists

Southwestern Society of Orthodontists

The Southwestern Society of Orthodontists will meet March 23, 24, and 25, 1943, at the Mayo Hotel, Tulsa, Okla.

Southwestern Society Members in Service

Members of the Southwestern Society of Orthodontists now in the Service are as follows:

Lt. R. T. Goldsmith,
Dental Dispensary, N.A.S.,
Corpus Christi, Texas.

Capt. W. R. Alstadt,
U.S. Air Corps,
1713—8th St.,
Wichita Falls, Texas.

Lt. J. Victor Benton, 0-372821,
Co. B. 47th Medical Bn.,
A.P.O.—251,
Care of Postmaster,
New York, N. Y.

1st Lt. Murray M. Hall,
Station Hospital,
Camp Howze,
Gainsville, Texas.

Lt. John W. Makei, D.C.,
United States Army,
Camp Bowie,
Brownwood, Texas.

1st Lt. Charles F. Russell,
Station Hospital,
Lowry Field,
Denver, Colo.

Lieut. J. D. Peak,
Bachelor Officers Quarters, No. 203,
U. S. Naval Reserve Aviation Base,
Dallas, Texas.

Lt. Tom M. Williams,
Lowry Field, Denver, Colo.

Major J. A. Rowe, D.C.,
Selman Field,
Monroe, La.

Lt. E. B. Pulliam,
D.C., U.S.N.R.,
C.C. Naval Air Station,
Corpus Christi, Texas.

1st Lt. H. S. Grohosky, D.C.,
Majors Air Field,
Station Hospital,
Greenville, Texas.

Lt. Paul E. Gilliam,
D.C., U.S.N.R.,
Marine Barracks,
Camp Elliott,
San Diego, California.

Lt. Ott L. Voigt,
M.D.R.P.—M.R.T.C.,
Camp J.T. Robinson, Ark.

Lt. Willis H. Murphey, P.A.,
Dental Surgeon,
U.S. Coast Guard,
Captain of the Port,
Tampa, Florida.

Prize Essay Contest Postponed

The Research Committee of the American Association of Orthodontists announces the postponement of the Prize Essay Contest until the next meeting is called by the Association.

In order that those contestants who have already submitted manuscripts may not be discriminated against through this action, and also to make their studies available to the rest of the profession, their manuscripts are being returned to them with full authority for publication, wherever they may place them. A list of such manuscripts is being held in the office of the chairman, and the manuscripts or reprints thereof will be called for at the time of the judging.

The deadline for submission of manuscripts has been postponed indefinitely and new manuscripts may be submitted for consideration at any time until further notice. All manuscripts will be judged at the same time.

American Board of Orthodontics

The American Board of Orthodontics announces the cancellation of its 1943 meeting previously scheduled to be held in conjunction with the meeting of the American Association of Orthodontists in May. Due notice will be given of the next meeting of the Board.

B. G. DEVRIES, Secretary.

Cleveland Dental Society

The annual spring clinic meeting of the Cleveland Dental Society will be held on May 10, 11, and 12, 1943, at the Statler Hotel, Cleveland, Ohio.

Announce Method of Procuring Army Dental Officers for 1943

The method to be followed in procuring medical and dental officers for 1943 has been announced in an official statement by the Medical Corps of the United States Army. The statement follows:

The Surgeon General is responsible for the procurement of medical and dental officers for the Army of the United States. There is an Officer Procurement Service set up by the War Department for the procuring of applications of individuals for commission in the Army. The War Manpower Commission has set up a Procurement and Assignment Service for Physicians, Dentists, and Veterinarians to designate the individuals who are essential to the community and those available for duty with the Armed Forces.

In order to coordinate the work of these two agencies, the Surgeon General has outlined the following procedure for the procurement of officers during the year 1943:

The state chairmen of the Procurement and Assignment Service for Physicians, Dentists, and Veterinarians will from time to time prepare lists of individuals who are declared available for duty. Their names will be sent to the Central Office of the War Manpower Commission in Washington, D. C. There a card will be prepared and sent to the individual informing him of the fact that he has been classified as available for military service and requesting that he send the attached card to the state chairman of the Procurement and Assignment Service signifying his interest in applying for a commission, and stating his preference for duty with the Army or Navy. Those who choose to serve in the Army may request that their papers be processed with the idea of assigning them to duty with the Air Forces.

The state chairmen will furnish the candidate to the designated field office of the Officer Procurement Service of the War Department. This office will request the individual physician, dentist, or veterinarian to complete the proper application blanks and return them to that office and to have a final type physical examination, which will be accomplished at the nearest properly equipped army post.

The Officer Procurement District's office will forward the papers to the Surgeon General in Washington, who will then review the application for commission in the Medical (or Dental) Corps, Army of the United States.

Those applications with the notation "Air" as designated will be referred to the Office of the Air Surgeon for further classification and assignment. Those applicants who are favorably considered will be notified at the earliest possible date by the Office of the Adjutant General that their recommendation is accepted and will receive orders to proceed to their proper station.

It is hoped by following this procedure that the Surgeon General will be able to provide an adequate medical (and dental) service for our Armed Forces. It is contemplated that all individuals who are classified as essential to the civilian medical (and dental) needs will not be asked to apply for a commission. No individual so classified need contact the Surgeon General or apply for a commission unless he can make arrangements with the state chairman of the Procurement and Assignment Service to have his classification changed from essential to available. The cooperation and interest of all physicians (and dentists) who are interested in military service will be appreciated, in that by proper application and processing of their case it will be much easier to provide necessary medical (and dental) care for all parts of both the civilian and military services. . . .

Appointments will be made by the Adjutant General of eligible applicants recommended by the Surgeon General and approved by the Secretary of War's Personnel Board.

(Reprinted from *The Journal of The American Dental Association* **30**: 346, 1943.)

Southern Society Meeting Cancelled

The 1943 meeting of the Southern Society of Orthodontists which was to have been held in Richmond, Va., has been cancelled on account of conditions brought on by the war.

E. C. LUNSFORD, Secretary.

Notes of Interest

Dr. S. A. MacKenzie, 1011 Stroh Bldg., Detroit, Mich., is the new associate editor of the Great Lakes Society of Orthodontists, replacing Dr. Richard Barnes who is now in Service.

Dr. Edward Ray Strayer announces the opening of his office at 269 S. 19th Street, Philadelphia, Pa. Practice limited to orthodontics.

Dr. Louis Braun announces the removal of his office from 765 David Whitney Bldg. to 1601-1603 David Whitney Bldg., Detroit, Mich. Practice limited to orthodontics.

The AMERICAN JOURNAL OF ORTHODONTICS AND ORAL SURGERY feels that its readers would be glad to be informed of the change of address and location of any orthodontists who have entered the Armed Services. If this information will be sent direct to the Editor, 8022 Forsythe Blvd., St. Louis, Mo., it will be published from time to time in the NEWS AND NOTES pages of the JOURNAL.

OFFICERS OF ORTHODONTIC SOCIETIES*

American Association of Orthodontists

President, J. A. Burrill _ _ _ _ _ _ _ _ _ 25 East Washington St., Chicago, Ill.
Secretary-Treasurer, Max E. Ernst _ _ _ 1250 Lowry Medical Arts Bldg., St. Paul, Minn.
Public Relations Bureau Director, Dwight Anderson _ 292 Madison Ave., New York, N. Y.

Central Section of the American Association of Orthodontists

President, Charles R. Baker _ _ _ _ _ _ _ _ _ _ _ _ 636 Church St., Evanston, Ill.
Secretary-Treasurer, L. B. Higley _ _ _ _ _ _ _ 705 Summit Ave., Iowa City, Iowa

Great Lakes Society of Orthodontists

President, Henry D. Cossitt _ _ _ _ _ _ _ _ _ _ _ 942 Nicholas Bldg., Toledo, Ohio
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New York Society of Orthodontists

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President, Ben L. Reese _ _ _ _ _ _ _ _ _ _ _ _ Roosevelt Bldg., Los Angeles, Calif.
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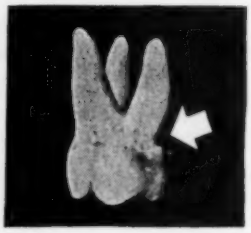
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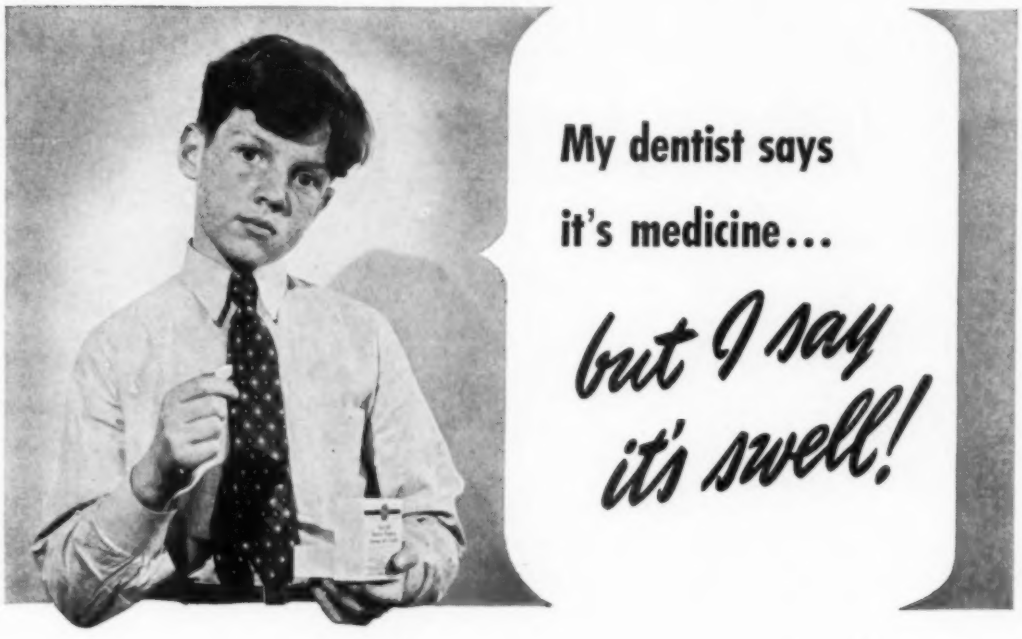
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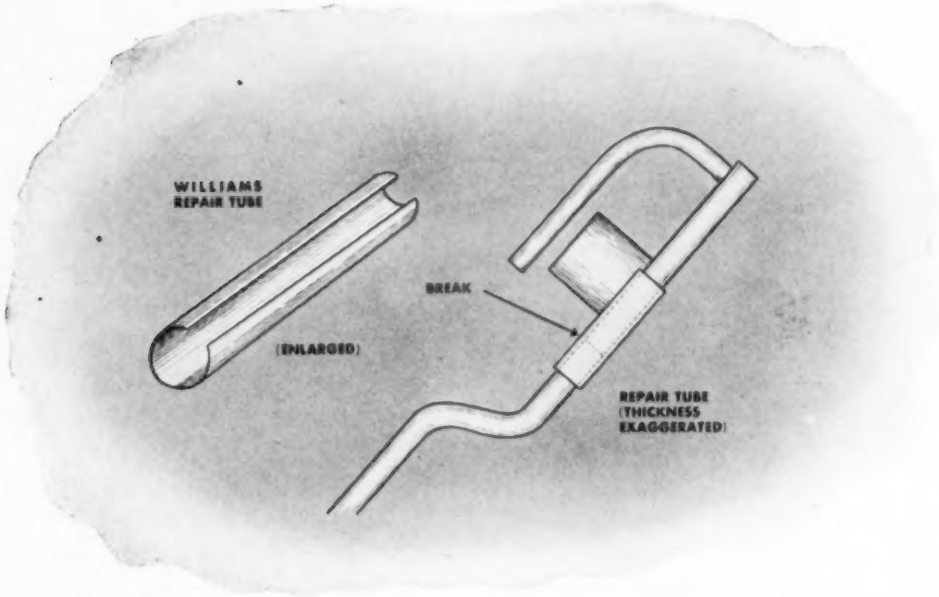
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American
Journal of Orthodontics
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VOL. 29 APRIL, 1943 No. 4

Original Articles

COMPARATIVE STUDY OF ORAL CHANGES IN DOGS DUE TO DEFICIENCIES OF PANTOTHENIC ACID, NICOTINIC ACID, AND UNKNOWNS OF THE B VITAMIN COMPLEX

HERMANN BECKS, M.D., D.D.S., W. W. WAINWRIGHT, D.D.S., M.S., AND AGNES FAY MORGAN, PH. D.
SAN FRANCISCO, CALIF.

THE wide application of natural as well as synthetic vitamins in the treatment of a large number of human ailments has resulted in a remarkable advancement in the field of vitamin therapy during the last decade.[1, 83, 88, 98] Caution must be expressed, however, against too great an enthusiasm because of possible set-backs which may be expected from the use of too large quantities of synthetic products such as those observed now as a result of vitamin D overdosage.[8] The biologic importance of the various fractions of vitamin B has again raised great hopes for the treatment of certain idiopathic clinical entities. It appears, however, that a number of undisclosed fractions of the vitamin B complex still obscure this picture.

Animal experimentation as well as clinical observation has demonstrated that certain fractions of the vitamin B complex are essential for the human body, while others have been shown as yet only to be required by other species.[21, 25, 26] The oral manifestations in human beings[31, 67, 74, 78, 82, 87, 96] of vitamin B fraction deficiencies as far as they are known today may be summarized as follows:

Nicotinic acid deficiency produces the major clinical symptoms,[41, 53, 79, 81, 10] observed to date, of any deficiency of the B vitamin group. The close associ-

From the George Williams Hooper Foundation for Medical Research, The Department of Home Economics, and the Division of Dental Medicine of the College of Dentistry, University of California, San Francisco and Berkeley, Calif.

Read in part before the meeting of the American Association of Orthodontists and Inter-American Orthodontic Congress, New Orleans, March, 1942.

Conducted under grants made by the American Foundation for Dental Science, the Research Board of the University of California, and the Josiah Macy, Jr. Foundation. The valuable assistance of Works Progress Administration Official Project 65-1-08-62, Unit A-24, assigned to the University of California is also acknowledged.

ation of this deficiency with the clinical symptoms of human pellagra is demonstrated by the spectacular and prompt disappearance of the characteristic stomatitis and glossitis upon the administration of nicotinic acid or its amide. One of the earliest diagnostic symptoms is the redness and swelling of the tongue, which starts particularly at the tip and lateral margins and later extends eventually to involve the entire surface of the tongue. In later stages the tongue becomes still more reddened assuming an intense, fiery scarlet hue. Simultaneously all of the oral mucous membrane becomes reddened with a resultant stomatitis, gingivitis, and pharyngitis complicated by the appearance of ulcerations along the sides, tip and under surface of the tongue, as well as on the buccal mucosa, particularly opposite the molar teeth. The ulcers usually present a thick grayish exudate or membrane on the surface which shows rich cultures of Vincent's organisms. At this stage of the disease the early period has long since been passed in which the patient complains of loss of weight and strength, and general lassitude with mild mental disturbances. By this time the patient shows the advanced symptoms of pellagra including: nausea, ptyalism, vomiting, diarrhea, abdominal distention, dermal lesions ("rough skin"), and severe mental disturbances. The latter are so great that it has been estimated that 10 per cent of the patients admitted to hospitals for the insane in endemic areas of the United States prior to the discovery of pellagra-preventive therapy, suffered only from the effects of vitamin deficiency.

The response to the administration of curative doses of nicotinic acid is often dramatic. The fiery redness of the oral tissues usually begins to disappear within twenty-four hours, and the ulcerations show noticeable healing within forty-eight to seventy-two hours. The gastrointestinal, mental, and cutaneous changes which are present may not disappear at an equally rapid rate.

Riboflavin deficiency has only recently been noted[75, 76] as a cause of oral diseases when eighteen women were placed on an experimental diet deficient only in riboflavin. After 94 to 130 days the oral mucous membrane and lips showed a peculiar pallor followed in a few days by a macerated appearance and transverse fissures near the corners of the mouth. The fissures resembled closely the lesions of perlèche and were about 0.5 mm. deep and 5 to 10 mm. long on the skin of the face and extended a millimeter or two onto the mucous membrane. There was little or no increased redness in the bottoms of the fissures. At the same time there was an appearance of abnormal redness along the line of contact of the upper and lower lips resulting from a superficial denudation of the mucosa. In addition a scaly desquamation, with a slightly greasy appearance, on a mildly reddened base appeared around the nostrils and in the vestibule of the nose and ears. Similar lesions were scattered over the face, averaging 1 mm. in length, and apparently derived from the sebaceous glands. These occurred most frequently in the nasolabial folds, alae nasi, bridge of the nose and the forehead above the eyebrows.

These skin lesions were promptly relieved by the administration of riboflavin, while no effect was obtained from nicotinic acid. Since the publication of these observations, it has been reported[67] that similar skin lesions are specific for riboflavin deficiency and that this is one of the most common isolated deficiencies that is objectively manifest; another report emphasizes other types of cheilosis which respond only to panvitamin therapy.[45]

Pyridoxine (an essential vitamin for chicks,[37] rats,[4, 5] and dogs[49]) is reported to alleviate tongue lesions in human beings resulting from a deficiency state which was not benefited by nicotinic acid, ascorbic acid, vitamin A or thiamin.[67] The tongue presents a markedly smooth appearance, especially at the edges, with a purple-red color, slight edema, and pain. The lower lip in one case was of a similar color without cheilosis. After no response to other vitamins during eight days of hospitalization, pyridoxine hydrochloride, given for two days, greatly improved the color and edema with control of the pain. On the fourth day of pyridoxine administration the color was almost normal and newly regenerated papillae appeared on the tongue. By the fifth day the lip had almost returned to normal.

Thiamin deficiency, although it brings about severe changes in the peripheral nervous and cardiovascular systems[34] resulting in the disease beriberi and related symptom complexes, produces no specific oral changes. It is possible, however, to observe atrophy of the tongue in severe deficiencies[31] and recently a case was reported presenting small pin-point vesicles on the mucous membrane of the cheek, palate, and undersurface of the tongue, resembling closely the early herpetic lesion; the condition was relieved by thiamin administration and was ascribed to a specific deficiency of thiamin.[96]

The therapeutic value of specific vitamins is a phase of their biologic action which may be separate from their relation to the relief of deficiency symptoms. A listing of these therapeutic uses in oral medicine includes for nicotinic acid: relief of pain in tic douloureux,[3, 64] often dramatic healing in Vincent's infection and other types of ulcerative gingivitis,[39, 73, 78 (see also 86)] aid in xerostomia,[68, 69] in human black tongue,[72] lessening of nausea and vomiting in sulfanilamide "sickness,"[19, 20, 47] an aid in treatment of herpes simplex,[15 (see also 14)] treatment of atypical psychotic states and other nervous diseases when associated with malnutrition,[16, 28, 33, 35, 36] lessening of diarrhea in sprue,[11] treatment of lichen planus,[91 (see also 13)] control of roentgen-ray "sickness,"[77, 27, 80] favorable effect on lead poisoning,[29] lupus erythematosus,[42] and tumors;[97] for thiamin: immediate relief of pain in "dry socket,"[77, 43] prevention of "dry socket,"[61] treatment of acne vulgaris;[44] and for multiple therapy: response in oral changes of Addison's disease,[59] stomatoglossitis of war refugees.[40]

It is probable that revision will be made of these recommendations of single vitamins for therapy of specific conditions. Several reports have appeared which suggest detrimental effects of large doses of single vitamins without increases of all vitamins, especially within the B group;[55, 62] possible exceptions have been reported.[93] Also the more experience clinicians have with deficiency diseases the more it is observed that panvitamin therapy is essential for control of all symptoms.[32, 83, 85, 26, 50, 67]

Of the remaining factors of the group of B vitamins, folic acid, choline and biotin, are not known as yet to be related to oral symptoms.[23] Although experimentally inositol is known to be involved in the loss of hair[104, 46, 105] (as well as pantothenic acid[105] and para-aminobenzoic acid[2] (and possibly pantothenic acid[30, 93, 22] although its influence has been doubted[60, 102]) or other members of the filtrate fraction[54, 57, 58] are involved in the greying of hair, no oral symptoms have been reported as yet in deficiencies of these vitamins. Of the

unknown factors awaiting discovery in both thermostabile and thermolabile groups, no suspicion has been voiced regarding oral complications.

Pantothenic acid, designated here as a part of the filtrate fraction, has been available in purified form only since 1940.[100, 101, 99] This substance has been suspected of being necessary for the maintenance of every tissue of the human body,[25, 84] and tentative human daily allowances have been set up.[26] Although no oral symptoms of deficiency have as yet been described in humans, severe changes are found experimentally in dogs[9] and monkeys.[90, 89] The dramatic changes observed early in the investigations of the biologic actions of this vitamin caused it to be labeled the "chick antidermatitis vitamin,"[66] which was later identified as pantothenic acid.[38, 106] Spinal cord lesions also were seen in the chick.[63] Shortly thereafter it was found to be necessary to prevent a typical dermatitis[18, 51, 52, 65, 92, 103] and hemorrhagic necrosis of adrenals in rats.[6, 17] A deficiency in dogs of the filtrate fraction (here used to designate the complex of pantothenic acid plus unknown factors) has produced loss of appetite, marked loss of weight, intermittent diarrhea, moderate anemia, and death.[48, 56, 70, 71, 94] Short-haired dogs showed ulcerations of the skin, long or wire-haired dogs did not.[24] In pigs, ulcers of the intestinal tract are reported in addition to many of the changes already mentioned in other species.[99] Severe oral changes have been produced experimentally in monkeys on a deficiency of filtrate fraction and pyridoxine.[90, 89] At the time of the experiment, 1939, the deficiency was designated as "B_2 complex deficient plus flavin and nicotinic acid." Although the actual lesions produced were not always the same, all of the monkeys showed severe gingival involvement and some developed conditions as severe as necrotic gingivitis with bone destruction and noma.

In a previous study[9] definite effects of deficiencies of the filtrate fraction of the vitamin B complex and of nicotinic acid on teeth and oral structures were found. This experiment, however, presented two disadvantages: Three of the six experimental animals were comparatively young, the oldest being only approximately 300 days old; and of the remaining three, two were placed on a filtrate fraction deficiency and one on a combined filtrate and nicotinic acid deficiency. It was therefore desirable to continue this study with more animals and different combinations of vitamin deficiencies.

All the animals included in this and the former study[9] received a purified basal diet which was constant in composition with one exception throughout the experiment. This was made up of washed casein, 45.8, sucrose, 20.9, cornstarch, 19.4, Crisco, 10.0, salt mixture No. 5,* 2.4, $CaCO_3$ 1.5. On March 10, 1941, the cornstarch was removed and sucrose increased to make up the difference. This was after 706 days on the diet for dogs 22, 30, and 31, after 249 days for dogs 33, 34, and 41, 393 days for dogs 23 and 32, and 364 days for dogs 24 and 25. Vitamin A, 25,000 I.U., and vitamin D, 750 I.U. per kg. body weight per day, were given in fish liver oil throughout the experiment to all animals. In addition all received by stomach tube daily crystalline thiamin hydrochloride, pyridoxine hydrochloride and riboflavin, 100 micrograms each per kilo. The control dogs received 1 mg. calcium pantothenate or an equivalent amount

*Made up (in grams) of calcium lactate 986.7, calcium acid phosphate 563.2, sodium chloride 224.4, potassium acid phosphate 203.5, magnesium sulfate 49.5, iron citrate 22.0, sodium fluoride 0.682, potassium iodide 0.055, manganese sulfate 0.2167, potassium aluminum sulfate 0.066.

of "filtrate fraction," a yeast concentrate made in the laboratory, and 2 mg. nicotinic acid, per kilo per day.

The expression "filtrate fraction" used in earlier publications was meant to cover all B vitamins except thiamin, pyridoxine, riboflavin, and nicotinic acid. As it later developed the chief constituent of this fraction is pantothenic acid, but by no means is it the only constituent. Whatever these unknown constituents are they were supplied by the concentrated yeast filtrate obtained by repeated extraction of brewer's yeast, the extract concentrated after treatment with fuller's earth to remove thiamin, pyridoxine, riboflavin, and most of the nicotinic acid. This preparation is here designated as yeast filtrate. It was fed in the amount which provided 2 mg. pantothenic acid per kilo per day. These yeast filtrates were assayed for pantothenic acid by microbiologic and biologic methods.

EXPERIMENTAL ARRANGEMENT AND MATERIAL

In contrast to the former experiment, for this report only pure-bred cocker spaniels were used. The following material includes 10 animals, of which 3 were controls, while the remaining 7 received diets deficient in various factors of the B complex as outlined in Table I.

TABLE I

DISTRIBUTION OF ANIMALS, TYPES OF DEFICIENCIES, AND LENGTH OF OBSERVATION

GROUP	DOG		SEX	TYPE OF DEFICIENCY			DURATION OF EXPERIMENT	AGE (IN DAYS)	
	NO.	NAME		NICOTINIC ACID	FILTRATE FRACTION	SYNTHETIC PANTOTHENIC ACID	DAYS	WHEN PLACED ON DIET	AT AUTOPSY
I	41‡	Pat	♀	+	+		635	61	696
	23	Shadow	♂	+	+		655	40	695
	25†	Kim	♂	+	+		595	58	653
II	30*	Bunny	♀	−	+		1016	47	1063
	31*	Cleo	♀	+	− + −		120 Deficiency 540 Curative 360 Deficiency	47	1067
	22*	Benny	♂	−	−		866	56	912
	32	Tar Baby	♀	−	−		807	46	853
III	34‡	Dilly	♀	+	−	+	626	62	688
	33‡	Daffy	♂	−	−	+	650	81	731
IV	24†	Pal	♂	+	− +		245 Deficiency 325 Curative	47	607

*Dogs 30, 31, and 22 are litter mates.
†Dogs 25 and 24 are litter mates.
‡Dogs 41, 34, and 33 are litter mates.

One group (dogs 22 and 32) received neither the filtrate fraction, that is the yeast concentrate, containing pantothenic acid and unknowns, nor nicotinic acid and remained on this deficiency 866 and 807 days, respectively. This is more than twice as long as the corresponding dog with the most marked gingival and osseous changes in the former study (dog 11). Dog 30 received no nicotinic acid for 1016 days, which is four times longer than dog 14 of the previous report, which had shown only slight changes; however, the yeast concentrate given this animal contained very small amounts of nicotinic acid. Dog

31 was placed first on a filtrate fraction deficiency; however, after 120 days it was found necessary to place her on a curative dose because of severe anorexia and paralysis. After 540 days on the curative dose, the deficient diet was resumed and continued for an additional 360 days. For comparative purposes dog 24 was placed on the same deficiency as dog 31 for 245 days and then received a curative dose for 325 days when it was sacrificed. An additional group of two animals (dogs 34 and 33) received not filtrate fraction but synthetic pantothenic acid. One of them (dog 34)* was given nicotinic acid while this was omitted in the other (dog 33).†

The control dogs were kept on the purified diet and protected against deficiency as indicated. With one exception (dog 33) all dogs were started on the experimental diets when they were between one and two months of age. Five were males and five females. The sex is especially mentioned here because of the possibility of differences between the two sexes in response to these deficiencies.

Because of the marked morphologic changes in the oral cavities, especially in the gingival and paradental areas, roentgenograms of the left lower jaws were made at the time of autopsy and representatives of the control and various experimental groups are reproduced in Fig. 1. The corresponding dog numbers are given on the left side of each roentgenogram. The roentgenograms of the lower jaws permit a comparison of size of jaws and teeth. The reproductions on the right side are enlargements of the molar and premolar areas which provide a detailed demonstration of the various destructive processes.

The control animal (dog 23) has by far the best developed osseous structure and the largest jaws and teeth with no atrophic changes of paradental tissues. Next in quality are the last two (dogs 33 and 24). All others show marked horizontal and vertical atrophy of the marginal paradental bone structure with various degrees of osteoporosis. The atrophic changes are notable since they occur in comparatively young adult animals. Since all animals used in this experiment were pure-bred cocker spaniels, for which normal food requirements for optimum growth and development had been previously determined, it can be concluded that the severe oral changes produced are specific manifestations of these deficiencies.

HISTOPATHOLOGIC ASPECTS OF PARADENTAL STRUCTURES

All control dogs, 41, 23, 25, as stated previously were kept on a purified diet and protected against nicotinic acid and the specified filtrate fraction deficiencies. Roentgenographically and histologically they developed good jawbone structure and large teeth without any evidence of pathologic changes. In some instances there was a slight subepithelial round-cell infiltration in the interdental papillae, as seen in Fig. 2, but in no case did this extend beyond the cemento-enamel junction involving the crest of the alveolar bone. The

*Dog 34 also received choline which was absent in the diets of all others, except in those receiving the yeast filtrate.

†Further details on dietary composition, course of experiment, other autopsy findings, etc., will be reported separately. However, it should be mentioned here that cornstarch formed part of the diet of these animals which apparently carried some of the unknowns because when this was replaced in a subsequent experiment (to be reported later) by sugar, some of the symptoms of the deficiency became more pronounced. (Some of the influences of cornstarch and sucrose on rats are given in[36].)

supporting bone showed normal resorption and apposition (Fig. 3). Figs. 2 and 3 may be used for comparison with the severe changes seen in the experimental animals.

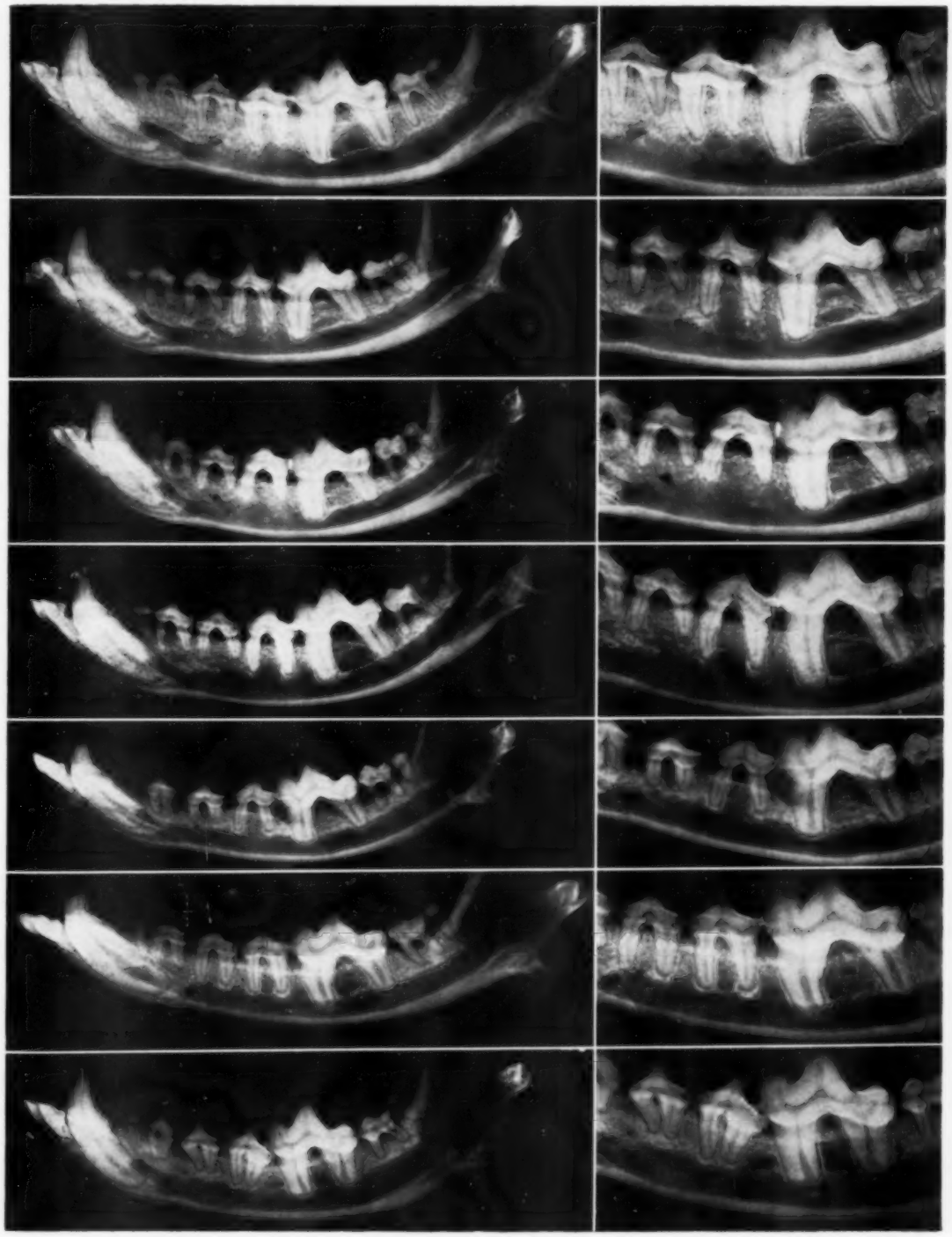


Fig. 1.—Comparative roentgenographic reproductions of the right lower jaws of representatives of all experimental groups (Table 1). The numbers of individual dogs are indicated on left hand side. Magnifications of premolar and molar areas for each animal are shown on right side. Note severe marginal atrophy in dogs 30, 31, 22, and 34.

Nicotinic Acid Deficiency.—Dog 30 was the only animal which remained on nicotinic acid deficiency for a period as long as 1,016 days, i.e., for almost 3 years. She was given the yeast filtrate but no nicotinic acid separately. At the end of the experiment she showed severe inflammatory changes of the entire oral mucous membrane and gingivae. Typical black tongue with foul erosions throughout the oral cavity described for this deficiency did not develop; however, the inflammation reached deep into the underlying connective tissue and bone structure of the tooth-supporting apparatus, which led to a



Fig. 2.

Fig. 3.

Fig. 2.—Control dog 23: Interdental papilla with slight subepithelial round-cell infiltration with no involvement of height of alveolar crest. (Spec. 4607, Pl. 7436.) (Imbedded in nitrocellulose, R.S. ½ sec.; stained with hematoxylin eosin; Zeiss Homal II, apochromatic 6; extension of camera 80 cm.; ×72.)

Fig. 3.—Control dog 25: Paradental bone structure under the bifurcation of a premolar with normal resorption and apposition. (Spec. 4522, Pl. 7862.) (Embedded in nitrocellulose, R.S. ½ sec.; stained with hematoxylin eosin; Zeiss Microtar f = 2 cm.; extension of camera 84 cm.; ×43.)

severe marginal atrophy with an involvement of practically all bifurcations of premolars and molars. The pathologic changes were very pronounced, quite in contrast to the much younger dog, 14, of the previous report[9] which was only 296 days old at autopsy and showed only slight and unspecific paradental

changes. This finding again emphasizes the importance of the duration of the experiment in the interpretation of clinical manifestations.

Pantothenic Acid and/or Unknown Filtrate Fraction Deficiencies.—The remaining six dogs were given only thiamin, riboflavin, and pyridoxine, some with and some without the addition of nicotinic acid and synthetic pantothenic acid. Dogs 31, 32, and 22 developed by far the most severe pathologic changes. Dog 31 received nicotinic acid but after a period of 120 days her physical condition made it necessary to place her on a curative dose of yeast filtrate for 540 days, after which this was withdrawn and the dog kept for an additional 360 days. The other two dogs, 32 and 22, received only thiamin, riboflavin, and pyridoxine until they were sacrificed. They are comparable with dog 11 of the previous experiment; with the difference that their experimental period

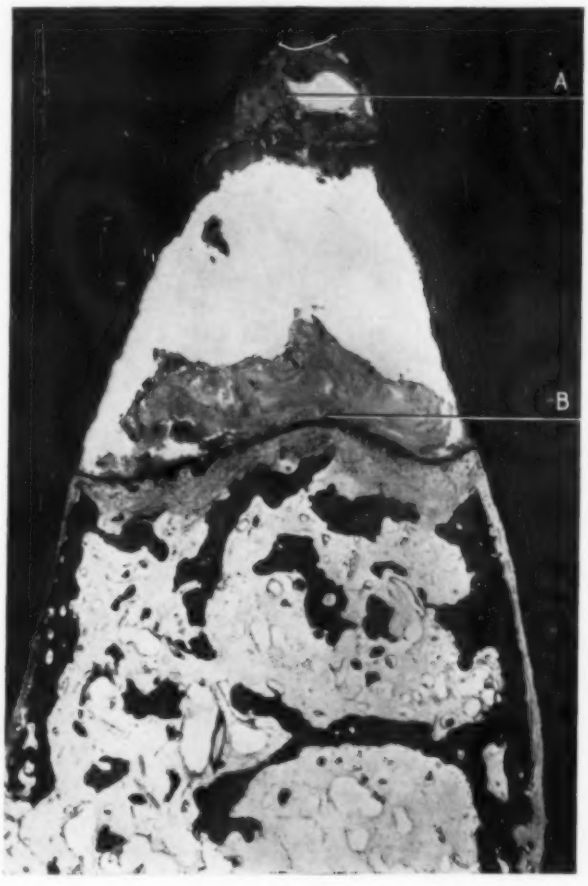


Fig. 4.—Dog 31 (complete filtrate fraction deficiency): Severe horizontal atrophy of marginal bone and soft tissue beyond the bifurcation. Mouth epithelium shows severe degenerative changes and desquamation (*B*); considerable calculus formation at (*A*). (Spec. 4631, Pl. 7409.) (Embedded in nitrocellulose, R.S. ½ sec.; stained with hematoxylin eosin; Zeiss Microtar f = 4.5 cm.; extension of camera 84 cm.; ×18.2.)

was extended to 866 and 807 days, respectively, as against the 343 days of dog 11. It is interesting to observe that no young dog receiving nicotinic acid but no pantothenic acid or other filtrate factors survived an experimental period of more than approximately 250 days without developing severe disturbances which endangered their lives. Nevertheless these dogs which had neither nicotinic acid nor the group of filtrate factors lived nearly three years.

Dog 31 developed most characteristic paradental changes, as already seen roentgenographically (Fig. 1); considerable atrophy and recession of the alveolar bone structure occurred even though the dog was still in its early adult years. Fig. 4 demonstrates the structures under the bifurcation of one of the premolars. There is heavy calculus formation (Fig. 4*A*) and the epithelial lining of the free margin of the gingivae is covered with large amounts of necrotic tissue which is in the process of sloughing off. Very little subepithelial

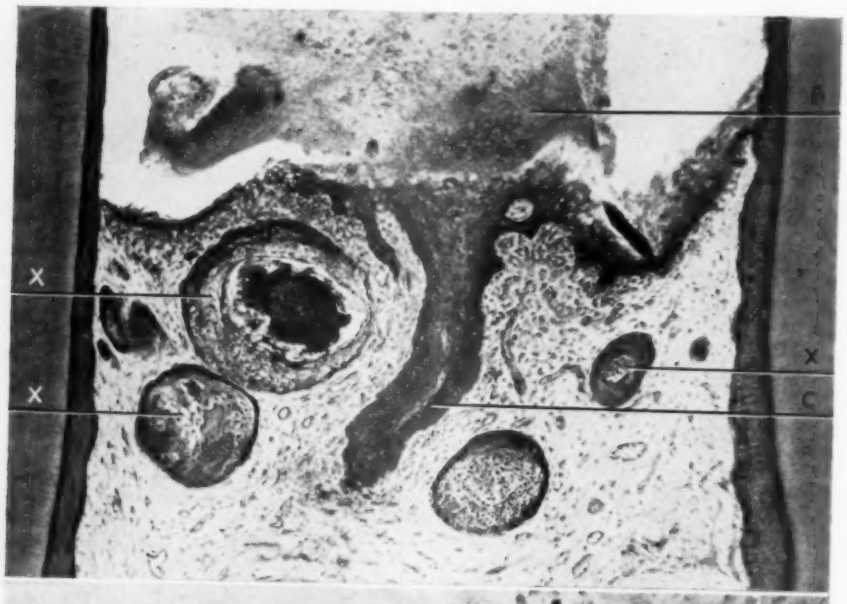


Fig. 5.



Fig. 6.

Fig. 5.—Dog 31 (complete filtrate fraction deficiency): Proliferation of mouth epithelium with large epithelial pearls (*X*) near the free margin of the gum which apparently has preceded the degenerative changes and desquamation (*B*) of the surface epithelium. Fingerlike epithelial spur at (*C*). (Spec. 4631, Pl. 7869.) (Embedded in nitrocellulose, R.S. ½ sec.; stained with hematoxylin eosin; Zeiss Homal VI, apochromatic 6; extension of camera 76 cm.; ×107.)

Fig. 6.—Dog 31 (complete filtrate fraction deficiency): Hyperkeratosis of the corneous layer of the gingival epithelium at (*A*) with complete degeneration and desquamation of the necrotic tissue at (*B*). Note absence of subepithelial round-cell infiltration. (Spec. 4631, Pl. 7469.) (Embedded in nitrocellulose; R.S. ½ sec.; stained with hematoxylin eosin; Zeiss Homal II, apochromatic 10; extension of camera 75 cm.; ×110.)

round-cell infiltration can be noticed, but the underlying bone structure is severely porotic, accompanied by an enlargement of the entire vasculatory system.

The changes in the surface epithelium are of special interest and will be described in more detail. In the majority of all interdental papillae and gingival margins a hyperkeratosis of a marked degree was found. Large epithelial "pearls" are noticeable near the epithelium (Fig. 5*X*) and the epi-



Fig. 7.

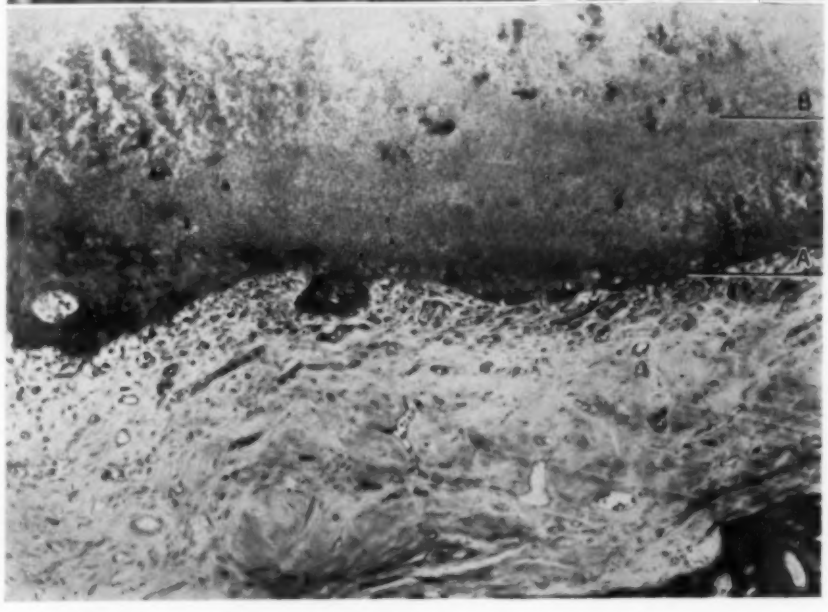


Fig. 8.

Fig. 7.—Dog 31 (complete filtrate fraction deficiency): Severe degeneration of mouth epithelium and sloughing of the necrotic tissue. The epithelium has been reduced to a fine line (*A*). (Spec. 4631, Pl. 7452.) (Embedded in nitrocellulose, R.S. ½ sec.; stained with hematoxylin eosin; Zeiss Microtar f = 2 cm.; extension of camera 83.5 cm.; ×42.)

Fig. 8.—Dog 31 (complete filtrate fraction deficiency): Magnification of degenerated mouth epithelium as seen in another serial section. Note the degree of epithelial changes (*A*) and sloughing of necrotic tissue (*B*). (Spec. 4631, Pl. 7870.) (Embedded in nitrocellulose, R.S. ½ sec.; stained with hematoxylin eosin; Zeiss Homal VI, apochromatic 10; extension of camera 65 cm.; ×150.)

thelial rests of Malassez are remarkably enlarged. The surface layer of the epithelium has sloughed off to a large extent (*B*), and fingerlike epithelial spurs reach deep into the connective tissue (*C*). In other sections the hyperkeratosis has the characteristic appearance as demonstrated at (*A*) in Fig. 6 followed by cell degeneration and complete necrosis (Fig. 6*B*). It may be noted that there is very little subepithelial round-cell infiltration, and resorption of the marginal bone seems to indicate a rather rapid atrophy. In some instances the epithelial degeneration and sloughing off has reduced the surface epithelium to a very fine line (Fig. 7*A*); in fact, not infrequently it has disappeared completely over large areas (Fig. 8*A*).

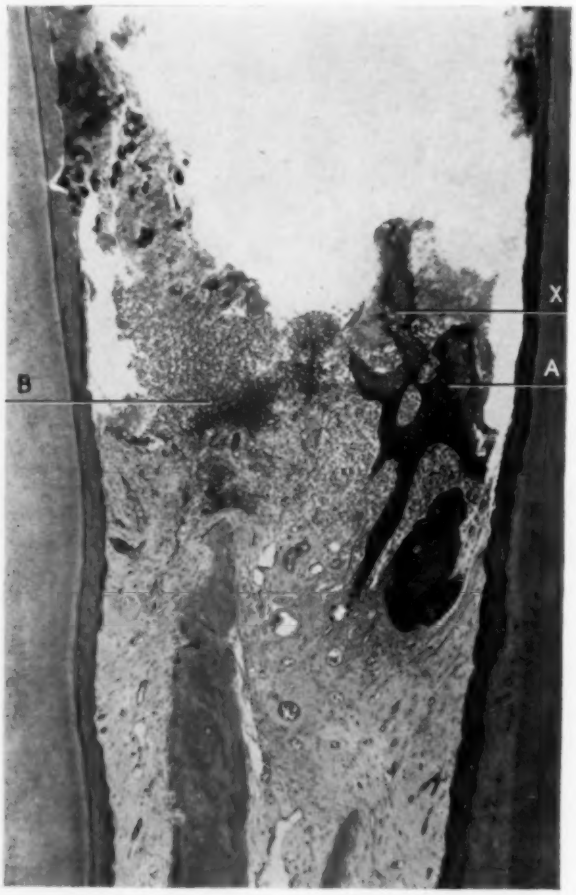


Fig. 9.—Dog 31 (complete filtrate fraction deficiency): Surface epithelium of interdental gingival papilla indicates severe degenerative changes at (*A*) and (*X*). Accelerated surface necrosis and desquamation is in progress while at (*B*) the entire epithelium shows the various states of karyolysis, karyorrhexis and pyknosis. There is comparatively little inflammatory reaction. (Spec. 4631, Pl. 7470.) (Embedded in nitrocellulose, R.S. $\frac{1}{2}$ sec.; stained with hematoxylin eosin; Zeiss Homal II, apochromatic 6; extension of camera 75 cm.; ×68.)

In other sections characteristic epithelial changes were noted as demonstrated in Fig. 9: on the right side the surface epithelium is still intact; however, degeneration of the surface layer is in progress at (*A*) and (*X*). At (*B*) all characteristics of normal mouth epithelium have been lost and various stages of cell death can be noted. A magnification of (*X*) in Fig. 9 is reproduced in Fig. 10.

Combined Filtrate Fraction and Nicotinic Acid Deficiencies.—The combined deficiency produced by far the most profound pathologic changes in the surface epithelium of the oral mucosa as well as the subepithelial connective tissue and underlying bone structure. Even though the changes vary somewhat in degree it can be generally stated that in addition to the degeneration of the epithelium with necrosis and desquamation, as seen in dog 31 (with filtrate fraction deficiency alone), an inflammatory tendency is added in dogs 22 and 32, which must be attributed to the nicotinic acid deficiency. The disintegration of the epithelium of the gingival margin with severe sloughing, subepithelial round-cell infiltration, and edema are demonstrated in Fig. 11 (dog 22). The pathologic changes in this area are similar to those reported for dog 11 of the previous report, with the only difference that they are more severe because of the extended experimental period.

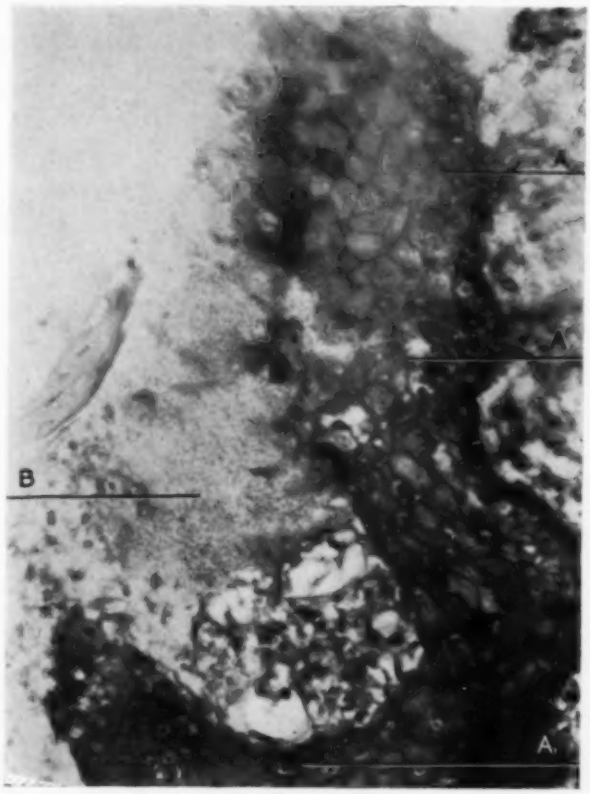


Fig. 10.—Dog 31 (complete filtrate fraction deficiency): Magnification of (*X*) of Fig. 9. Severe degeneration and various stages of necrosis can be seen at (*A*) with complete cell death and desquamation at (*B*). (Spec. 4631, Pl. 7865.) (Embedded in nitrocellulose, R.S. ½ sec.; stained with hematoxylin eosin; Zeiss Homal II, apochromatic 40; extension of camera 77 cm.; ×450.)

In some areas the gingival margin shows severe inflammation with granulation tissue formation (Fig. 12) but otherwise good jawbone structure. Due to the inflammatory process, which appears to be identical with that observed in the nicotinic acid deficient dog, the marginal alveolar crest has been markedly resorbed in the presence of large numbers of osteoclasts. The epithelial tissue has lost its characteristic appearance. In other areas the epithelium of the gingival papilla is still present but is rapidly sloughing off (Fig. 13*A*).

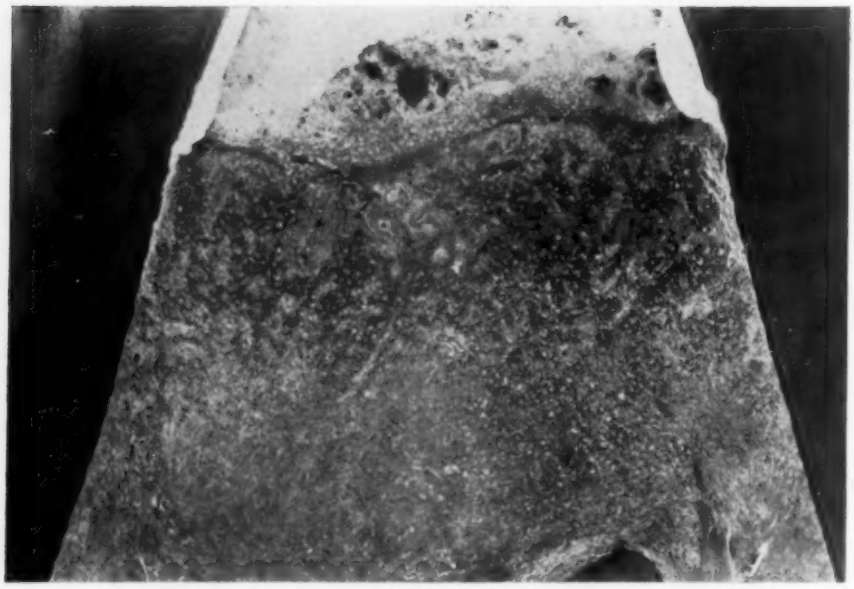


Fig. 11.—Dog 22 (nicotinic acid and filtrate fraction deficiency): Interdental gingival papilla shows marked inflammatory process, severe edema, and sloughing of degenerated surface epithelium. (Spec. 4604, Pl. 7860.) (Embedded in nitrocellulose, R.S. ½ sec.; stained with hematoxylin eosin; Zeiss Microtar f = 2 cm.; extension of camera 90 cm.; ×45.)

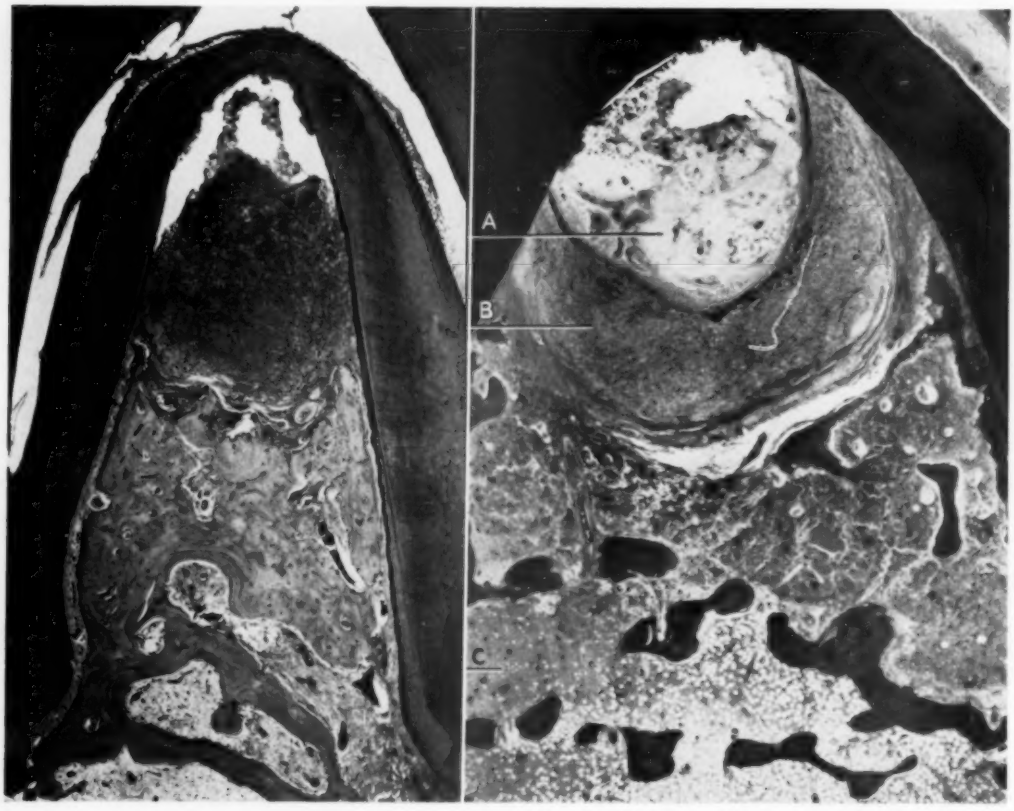


Fig. 12. Fig. 13.

Fig. 12.—Dog 22 (nicotinic acid and filtrate fraction deficiency): Marked inflammatory reaction of receded free gingival margin under bifurcation of premolar. Surface epithelium has been destroyed. Considerable horizontal atrophy can be noted. (Spec. 4604, Pl. 7465.) (Embedded in nitrocellulose, R.S. ½ sec.; stained with hematoxylin eosin; Zeiss microtar f = 4.5 cm.; extension of camera 90 cm.; ×19.)

Fig. 13.—Dog 22 (nicotinic acid and filtrate fraction deficiency): Necrosis and desquamation of surface epithelium (*A*) with granulation tissue formation (*B*). Marked osteoporosis and edema (*C*). (Spec. 4605, Pl. 7466.) (Embedded in nitrocellulose, R.S. ½ sec.; stained with hematoxylin eosin; Zeiss Microtar f = 4.5 cm.; extension of camera 90 cm.; ×19.)

There is a large amount of subepithelial granulation tissue (*B*) which has entered the marrow cavities, with considerable bone resorption and edema (*C*).

In other regions combinations are found in which parts of the mouth epithelium have degenerated and parts are still present, accompanied by extreme desquamation of the superficial tissue and severe inflammatory reaction involving bone structure and marrow cavities (Figs. 14 and 15).

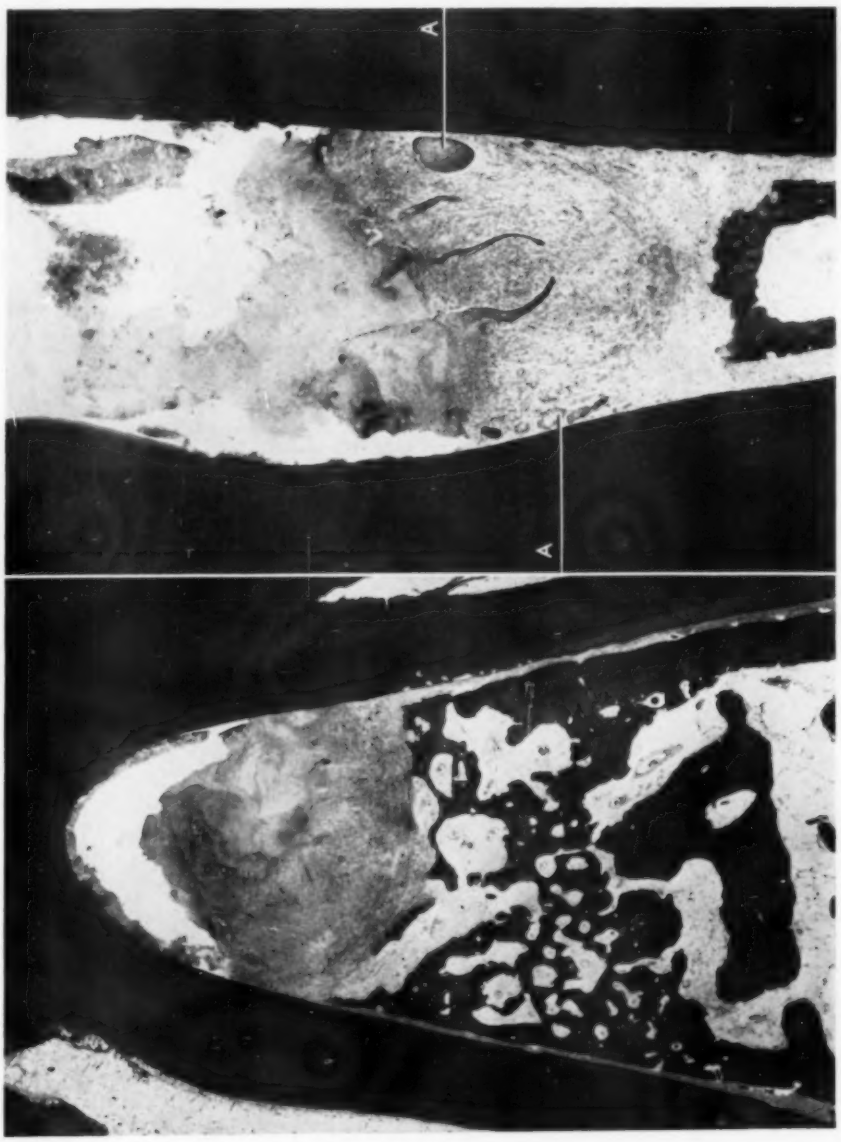


Fig. 14.

Fig. 14.—Dog 32 (nicotinic acid and filtrate fraction deficiency); Changes described for Figs. 11, 12, and 13 are more pronounced in this animal. Inflammatory reaction with granulation tissue formation and necrosis of epithelium is most pronounced. (Spec. 4634, Pl. 7456.) (Embedded in nitrocellulose, R.S. ½ sec.; stained with hematoxylin eosin; Zeiss microtar $f = 4.5$ cm.; extension of camera 90 cm.; ×19.)

Fig. 15.

Fig. 15.—Dog 32 (nicotinic acid and filtrate fraction deficiency); Malassez's epithelial remnants are markedly enlarged near the surface at (*A*) in the presence of granulation tissue formation and necrosis of the major portion of the gingival epithelium. Note marked degree of horizontal atrophy of the interdental bone. (Spec. 4634, Pl. 7410.) (Embedded in nitrocellulose, R.S. ½ sec.; stained with hematoxylin eosin; Zeiss microtar $f = 2$ cm.; extension of camera 84 cm.; ×42.)

It is interesting to observe that this inflammatory tendency is absent in dog 31 which received nicotinic acid; however, the epithelial degeneration and sloughing are identical, which must therefore be attributed primarily to the filtrate fraction deficiency. A magnification, with the processes of karyolysis, karyorrhexis, and pyknosis, is presented in Fig. 16. The cytoplasm of the individual cells becomes swollen and homogeneous and loses its normal reticulated appearance. There is a gradual loss of the normal sharp cell contour and

the boundaries are finally obliterated. Within the osseous structure, especially near the marginal area of the jawbone, considerable edema is found with an enlargement of the entire capillary system (Fig. 17) accompanied by marked osteoclastic activity and osteoporosis.

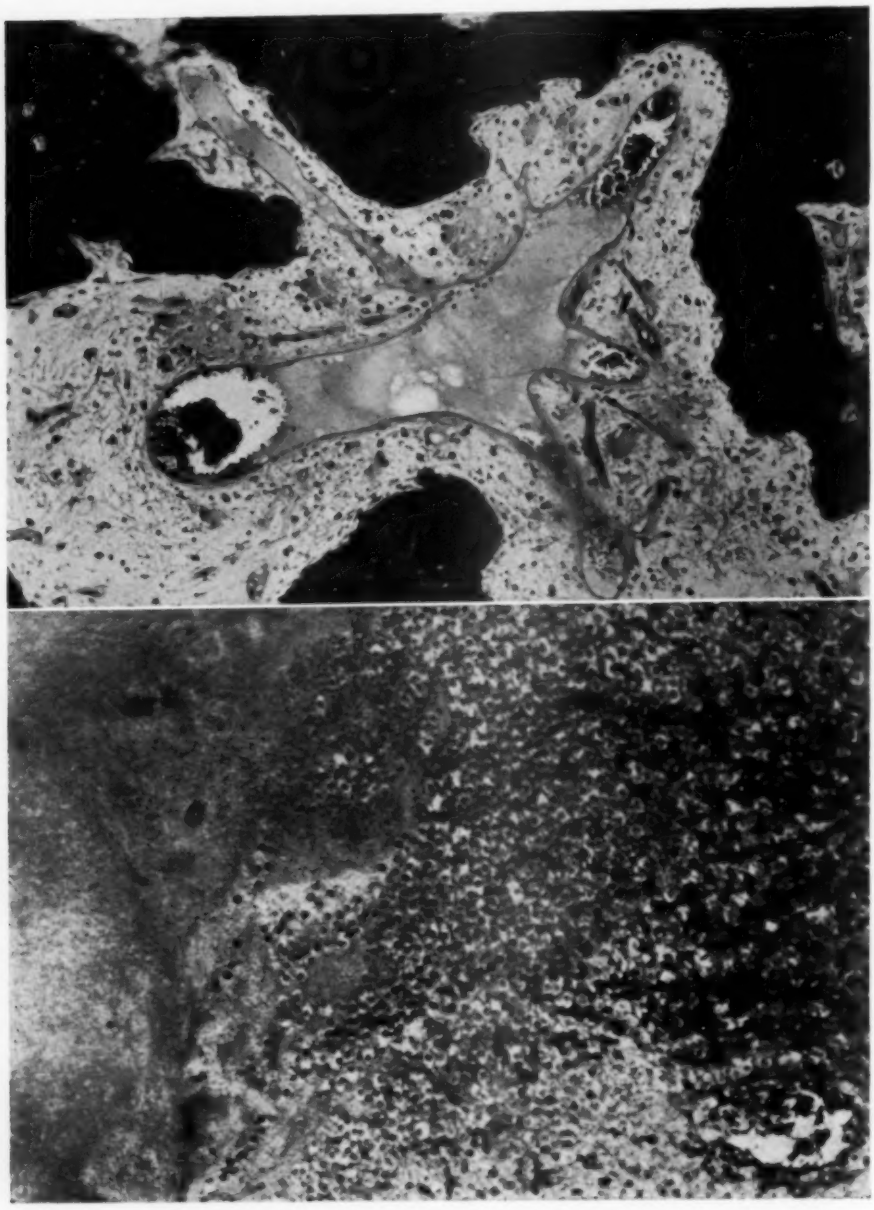


Fig. 16.

Fig. 16.—Dog 32 (nicotinic acid and filtrate fraction deficiency); Various stages of epithelial degeneration and necrosis of the mouth epithelium. (Spec. 4634, Pl. 7461.) (Embedded in nitrocellulose, R.S. ½ sec.; stained with hematoxylin eosin; Zeiss Homal VI, apochromatic 10; extension of camera 95 cm.; ×230.)

Fig. 17.—Dog 32 (nicotinic acid and filtrate fraction deficiency); Marked enlargement of entire capillary system in the marrow cavities and edema. (Spec. 4634, Pl. 7462.) (Embedded in nitrocellulose, R.S. ½ sec.; stained with hematoxylin eosin; Zeiss Homal VI, apochromatic 10; extension of camera 62 cm.; ×145.)

Deficiency of Unknowns Only and Unknowns and Nicotinic Acid.—The next group of two animals, dogs 34 and 33, were again kept for a period of 626 and 650 days, respectively; both received synthetic pantothenic acid in addition to thiamin, riboflavin, and pyridoxine. Of the two animals dog 34 developed the more severe paradental changes in spite of the fact that she was given adequate amounts of nicotinic acid. The epithelial changes are similar to those observed in dog 31 with some degeneration and desquamation, but they are by no means

as extreme. Although considerable recession of bone and gingival tissue has taken place, subepithelial round-cell infiltration is negligible (Fig. 18) which again may be attributed to the presence of nicotinic acid.

Quite in contrast dog 33 (without nicotinic acid) shows severe subepithelial infiltration (Fig. 19), but far less bone resorption. In fact, this animal shows roentgenographically and histologically less atrophic changes than any of the other experimental animals, and the only reason which can be given for this for the time being is the possibility of changes being less severe in males. It

Fig. 18.

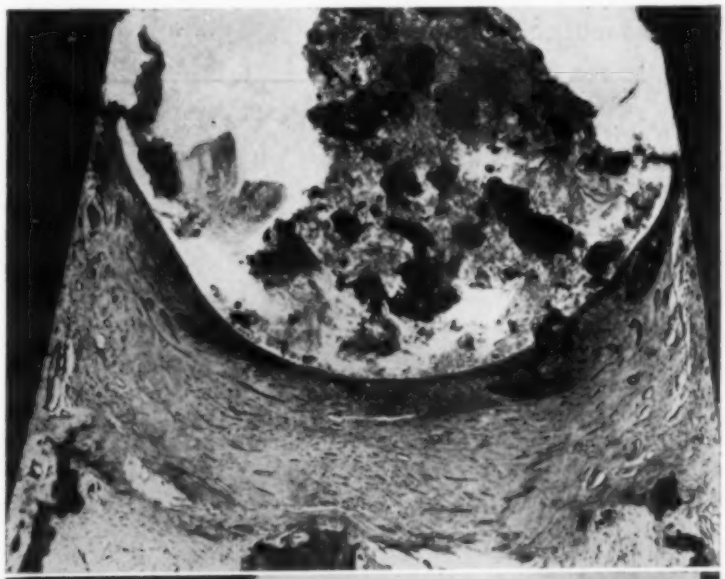


Fig. 19.

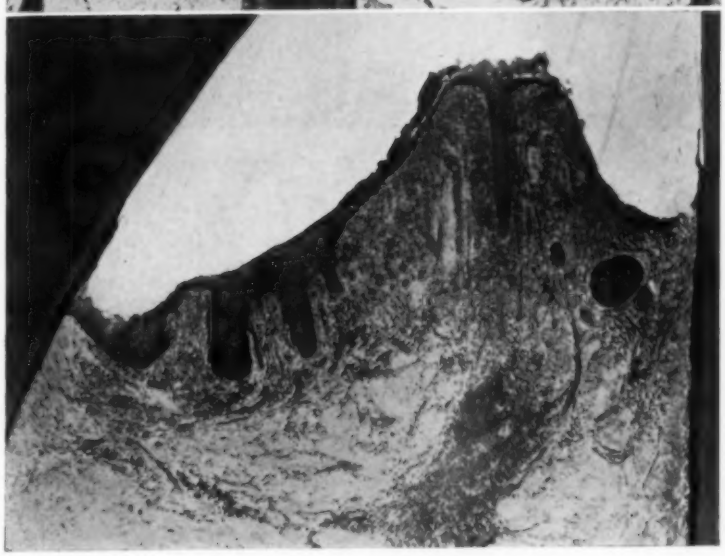


Fig. 18.—Dog 34 (deficiency of unknowns only, given synthetic pantothenic acid): Severe calculus formation and desquamation of surface epithelium with little subepithelial round-cell infiltration. Condition is not as marked as in dogs 22 and 32; however, considerable horizontal bone atrophy has taken place. (Spec. 4640, Pl. 7867.) (Embedded in nitrocellulose, R.S. ½ sec.; stained with hematoxylin eosin; Zeiss Homal II, apochromatic 6; extension of camera 77 cm.; ×70.)

Fig. 19.—Dog 33 (deficiency of nicotinic acid and unknowns, given synthetic pantothenic acid): Epithelial changes are less marked; however, subepithelial round-cell infiltration is very pronounced. (Spec. 4637, Pl. 7866.) (Embedded in nitrocellulose, R.S. ½ sec.; stained with hematoxylin eosin; Zeiss Homal II, apochromatic 6; extension of camera 77 cm.; ×70.)

appears that female dogs react much more quickly to these deficiencies than do males. It is interesting to note that dog 33 showed considerable abrasion of all incisal edges and cusps for which no explanation can be given as yet (Fig. 20). In general it can be said that the epithelial changes observed in these two animals are by no means as severe as those of the corresponding dogs 31, 22, and 32, and since the synthetic pantothenic acid is the only variable, it appears that this component of the filtrate fraction had a beneficial effect and prevented the development of such extreme pathologic changes as were seen in the other animals. However, it is evident that unknown factors present in the yeast filtrate are needed for protection of the mouth tissues.



Fig. 20.—Dog 33 (deficiency of nicotinic acid and unknowns given synthetic pantothenic acid): Marked abrasion of all incisal edges and cusps.

Curative Effects of Yeast Filtrate.—The last experimental animal is dog 24 which received the same deficient diet as dog 31, with the difference that the experimental period was very much shorter (245 days) (in fact only one-half of that of dog 31); he then received a curative dose of yeast filtrate for 325 days and was sacrificed. The roentgenograms (Fig. 1) indicate a very small mandible similar to that of dog 34 and only a slight degree of marginal alveolar atrophy. The bifurcations of premolars and molars are becoming involved; however, in general the pathologic condition is far less pronounced than in any other animal. This may be due in part to the shorter experimental period, the curative dose, or to the fact that dog 24 was a male. Nevertheless active resorption of alveolar bone was still in progress at the time of autopsy as demonstrated in Figs. 21 and 22. Large numbers of osteoclasts together with new formation of bone can be found everywhere, even though osteoporotic areas are also frequent, as also reported previously for dogs 10 and 12.[9] The mouth epithelium does not show severe degenerative changes and sloughing; however, the gingival tissues were slightly inflamed with the histologic charac-

teristics of gingivitis in some areas and with deeper changes involving the underlying bone structure in others. For comparative purpose the appearance of a typical interdental papilla of this dog is demonstrated in Fig. 23.

SUMMARY AND CONCLUSIONS

The purpose of this study was to extend a previous investigation[9] of the clinical oral symptoms and skeletal changes produced by depriving pure-bred cocker spaniels of various fractions of the vitamin B complex. The original experimental period was doubled or tripled and additional combinations of vitamin B fraction deficiencies were studied. In spite of the fact that severe pathologic changes were produced in all animals, caution must be exercised in drawing generalized conclusions since only one or two animals were used for each type of deficiency. It is furthermore questionable whether other species



Fig. 21.—Dog 24 (complete filtrate fraction deficiency plus curative dose): Resorptive activity of the alveolar bone structure under the bifurcation of premolar in the presence of a large number of osteoclasts (*A*). Note new formation of bone (*B*). (Spec. 4610, Pl. 7458.) (Embedded in nitrocellulose, R.S. ½ sec.; stained with hematoxylin eosin; Zeiss Homal II, apochromatic 6; extension of camera 77 cm.; ×70.)

of animals will react in the described manner, and also whether these findings can be ultimately applied to human beings. The great similarity, however, between these experimental lesions and certain conditions observed in daily dental practice makes it imperative to study on a larger scale the effect of newly discovered vitamin fractions in relation to the many perplexing oral lesions of obscure etiology.

The pathologic changes in the oral tissues of these animals were mainly restricted to the oral mucosa and the underlying alveolar bone and appeared to be specific for each deficiency. The following conclusions may be drawn from these experiments:

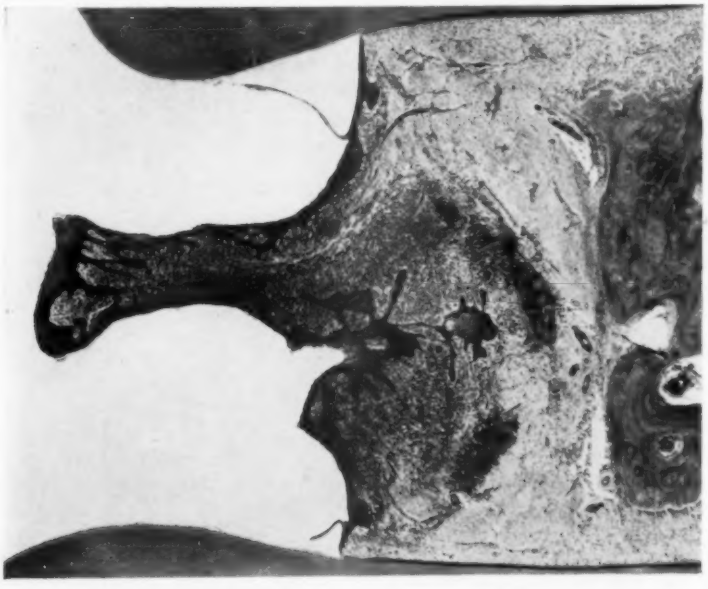


Fig. 23.

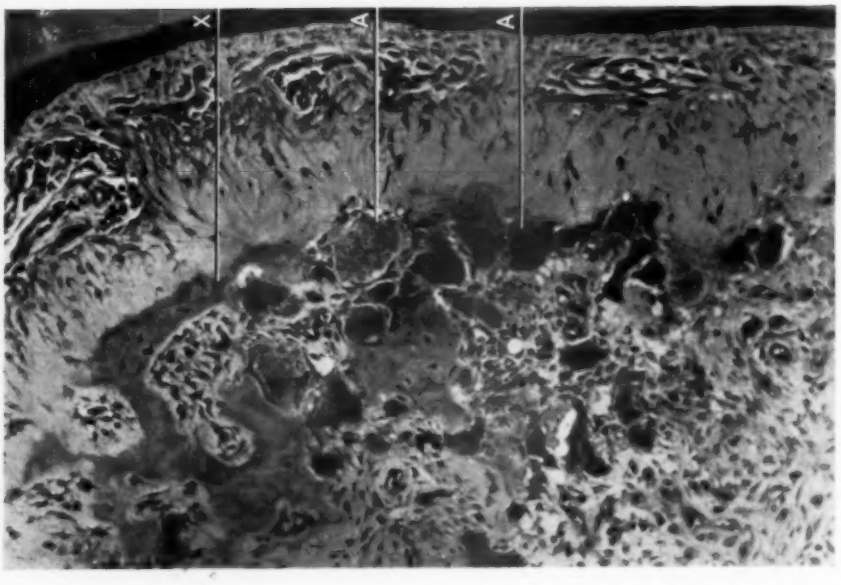


Fig. 22.

Fig. 22.—Dog 24 (complete filtrate fraction deficiency plus curative dose); Enlargement of area (*B*) of Fig. 21 with new formation of bone (*X*) in the presence of a large number of osteoclasts (*A*). (Spec. 4610, Pl. 7460.) (Embedded in nitrocellulose, R.S. ½ sec.; stained with hematoxylin eosin; Zeiss Homal VI, apochromatic 10; extension of camera 90 cm.; ×215.)

Fig. 23.—Dog 24 (complete filtrate fraction deficiency plus curative dose); Interdental gingival papilla with severe subepithelial inflammation. Epithelial degeneration as noted in dog 31 is absent apparently because of the curative dose. (Spec. 4610, Pl. 7868.) (Embedded in nitrocellulose, R.S. ½ sec.; stained with hematoxylin eosin; Zeiss Homal II, apochromatic 6; extension of camera 77 cm.; ×70.)

1. The findings in animals on filtrate fraction, i.e., pantothenic acid and unknowns, nicotinic acid, and combined filtrate fraction and nicotinic acid deficiencies, previously reported, were confirmed in this study. The extended experimental period led, however, to more pronounced changes. The marked root resorptions and dental caries seen in dog 12 of the former report were not found, although this may be due to a difference in breed of animal, since all dogs in the former study, unlike the present one, were not pure-bred cockers.

2. Nicotinic acid deficiency over a period of approximately three years produced very marked gingival and paradental changes. Severe inflammation of the entire mucous membrane occurred with an involvement of the tooth-supporting osseous structure, and accompanied by marginal atrophy resembling the inflammatory type of paradentosis in human beings. Typical black tongue with foul erosions throughout the oral cavity did not develop in either the complete (dogs 22 and 32) or partial deficiencies (dogs 30 and 34).

3. Deficiency in the entire filtrate fraction of the B complex leads invariably to severe impairment of health in young growing dogs; the effect is less marked in older cocker spaniels (if a curative dose is given to maintain life at the younger period with a return to the deficient diet). If protected against a nicotinic acid deficiency gingival inflammation is practically absent; however, changes in the oral epithelium show all characteristics of degeneration which is preceded by hyperkeratosis and enlargement of the epithelial rests of Malassez near the epithelial attachment. In many instances the surface epithelium was reduced to a fine line, accompanied by a rapid desquamation of the necrotic layers which showed the various stages of karyolysis, karyorrhexis, and pyknosis. More extreme degenerative changes were also observed; in some areas the epithelial covering had completely disintegrated and left the paradental connective tissue and peridental fibers exposed to the various external influences of the oral cavity. This necrosis and desquamation of epithelial tissue appear to be specific for prolonged filtrate fraction deficiencies. This change is seen again in the next group with the combined filtrate fraction and nicotinic acid deficiency. The alveolar and supporting bone showed marked osteoporosis and progressive marginal atrophy. The alveolar atrophy, without marked inflammation, in young adult dogs, presents a condition resembling the atrophic type of paradentosis in human beings.

4. If nicotinic acid, pantothenic acid and the unknowns of the filtrate fraction are omitted over a period of more than two years, severe inflammation and edema are added to the changes described under paragraph 3. This emphasizes the specific effect of nicotinic acid deficiency on the health of gingival and subgingival tissues. Marked circulatory disturbances were also noted in this group.

5. The effect of deficiency in the unknowns only was tested by the addition of synthetic pantothenic acid to the diet of two animals which received also thiamin, riboflavin, and pyridoxine, and one of which also received nicotinic acid. Far less epithelial necrosis and desquamation were produced in these animals than in the groups of paragraphs 3 and 4. It, therefore, appears that of the various components of the filtrate fraction, pantothenic acid is most effective in preventing the severe pathologic changes described in paragraphs 3 and 4, and inversely, that its lack produces these specific changes, although the oral tissues of such animals are not normal.

6. The curative effects of yeast filtrate were studied in one animal which was previously placed on a filtrate fraction deficiency (protected at the same time against nicotinic acid deficiency). The period of deficiency was 245 days and the curative period, 325 days. At the time of autopsy it showed none of

the characteristic changes described in paragraph 3. This supports the previous conclusion that these changes were produced specifically by the deficiency in pantothenic acid and unknowns in this fraction of the B complex. It also indicates that the damage resulting is not rapidly nor completely reversible.

Although only a comparatively small number of animals have been reported thus far, the histopathologic changes produced in this experiment suggest that not only nicotinic acid but also pantothenic acid and one or more, if not all, of the other components of the filtrate fraction are essential for the health of the oral tissues and jawbone structures. It is not possible as yet to determine definitely which fraction other than pantothenic acid is of greater or less importance for the animal body; however, further studies are under way to clarify this question.

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VARIATIONS IN THE USE OF THE LABIO-LINGUAL APPLIANCE*

Case Report

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IT IS a recognized fact that the profession as a whole does not agree as to the proper time to begin orthodontic treatment. Dr. H. E. Kelsey says, "The time to begin treatment is when, through observation and experience, one has arrived at the honest conviction that the case is developing along the abnormal, that it is growing worse, and there is no hope of the patient overcoming it."[1]

In the cases that we plan to show and describe, we have waited to begin treatment until we thought that nature would not correct the abnormality. In each of these cases we ran a case history in which the patients were checked for cavities, glandular disturbances, childhood diseases, tissue tone, and general condition. Included in this examination were also orthodontic models and dental x-rays. Scientific men will concede that it is impossible to make a diagnosis properly and thoroughly without the assistance of radiography. In all these cases we used labial and lingual appliances on both upper and lower arches.

Fig. 1 shows the models of a child 7 years of age. This case was begun in August, 1940. The x-rays showed that all teeth were present and were normal in their development. The child had a distal relation of the mandible to maxilla with a marked protrusion of her maxillary anterior teeth, complicated by mouth breathing. The mandibular lateral incisors were erupting lingually, and there appeared to be no room for these teeth. This child had been under observation for about eight months before treatment was started. In this case we planned to bring the teeth to a normal position, hold them there for a short time, and then remove the appliances with the idea that they would need replacing later. We banded the four second deciduous molars, constructed both labial and lingual appliances for the upper and lower arches. For attachment of the lingual appliances to the molar bands we used half round tubes. For the attachment of the labial arches we used round tubes to fit 0.040 wire; hooks were placed at cuspid areas on the maxillary labial appliance. We gave this child intermaxillary rubber bands to wear from the posterior of the lower labial appliance to hooks on the upper labial arch.

The other model shown in Fig. 1 is a progress model made in June, 1941, in which the anterior teeth are in alignment, and the jaw relation is normal for this age. The appliances were worn for six months and then they were removed. So far, we have not had to replace the appliances, but plan to do so in the near future to attain an ideal case.

Fig. 2 shows models of a boy, 13½ years of age, with a mesial relation of his mandible to maxilla, maxillary anterior teeth lingual to the mandibular anteriors, and a crossbite on the right side. This abnormality was definitely

*Models discussed in report were among group in "Labio-Lingual Technic" Clinic at Pan-American Meeting of American Association of Orthodontists in New Orleans, 1942.

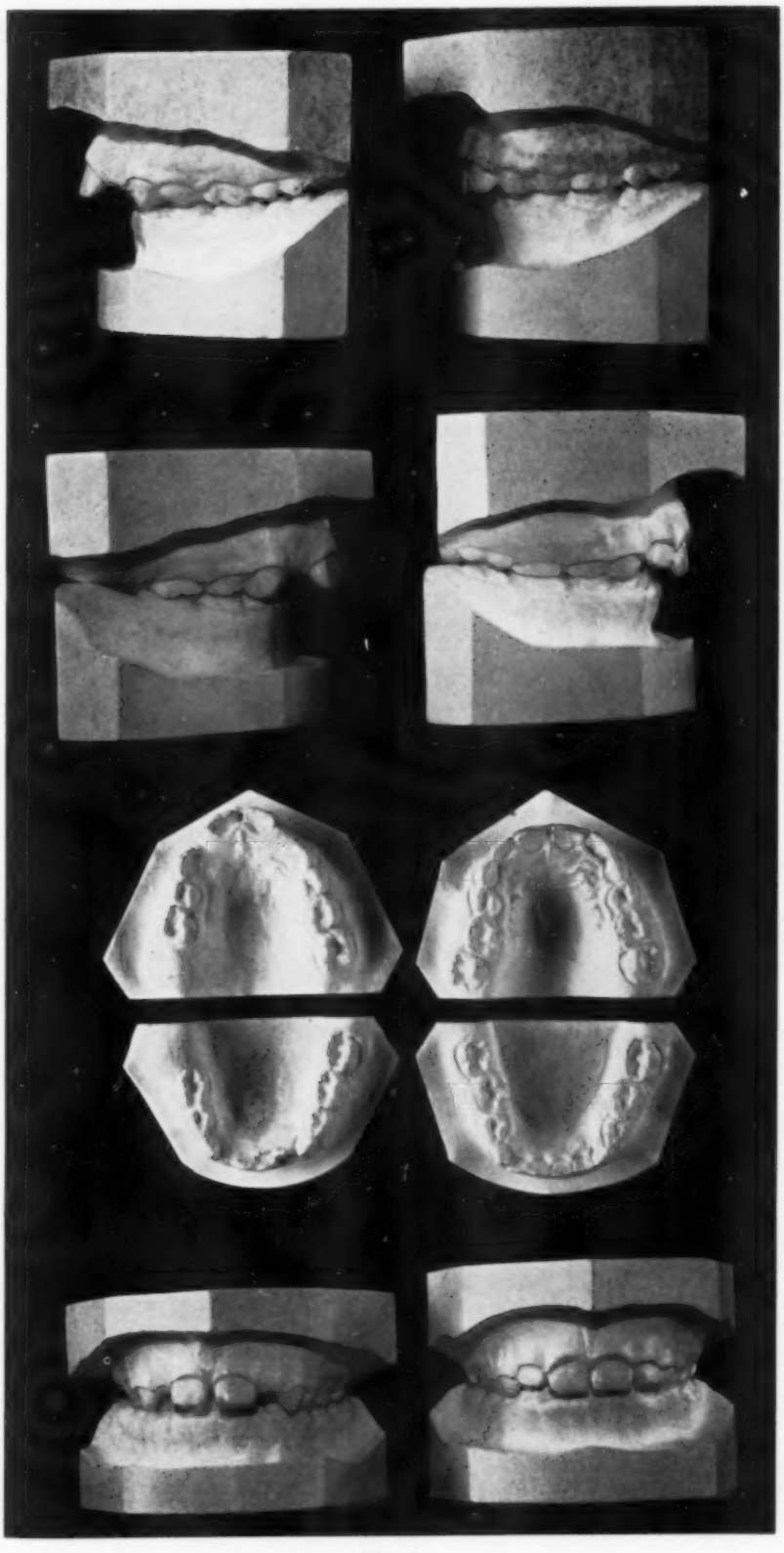


Fig. 1.



Fig. 2.

visible in the contour of his face. The radiographs showed that all permanent teeth were present and that they were normal in their development. We constructed molar bands on his four first permanent molars. In the upper arch we placed a half round tube on the lingual of the upper left molar band; on the upper right molar band we placed horizontally a round tube to fit 0.040 wire. We constructed a lingual appliance for the upper which had a half round post on the left side, the right side slipping into the round tube on the upper right molar band. Stabilizers were placed between the cuspid and bicuspid teeth. A horizontal posterior-recurved auxiliary spring was soldered on the right side of the upper lingual appliance. In the same plane as the long axis of the molars, we soldered a hook on the round tube which was placed on the lingual side of the maxillary right first molar. In the lower arch, half round tubes were placed on the lingual of both molar bands. A lingual appliance was constructed with attachment to the half round tubes by means of half round posts. We also constructed a bite stop or horizontal mesio-incisal guide plane[2] on the anterior part of the lower lingual. This bite stop was more or less a horizontal ledge made of interlocking wire which ran from the distal of one lateral to the distal of the other lateral. When the patient closed his mouth, his maxillary anterior teeth struck the bite stop and prevented the teeth from locking lingual to the lower anterior teeth. The regular labial appliances were constructed for both upper and lower arches. In the cuspid region hooks were soldered to the lower labial appliance. Also, a hook was soldered on the lower right buccal tube down toward the tissue so as not to scratch the cheek. The patient was given elastic rubber bands to wear from the posterior of the upper labial appliance to the hooks at the cuspid region on the lower labial appliance. All of the lower anterior teeth were tied up securely with steel ligature wires to the labial appliance to prevent the tipping of the mandibular first molars when the intermaxillary bands were worn. A band was also worn from the hook on the lingual of the maxillary right first molar to the hook on the buccal of the mandibular right first molar. This patient cooperated 100 per cent, and in November, 1940, he had made the progress that is shown to the right in Fig. 2. We recently completed this case with all teeth coming into their proper place and resulting in an excellent set of teeth. His facial contour has been markedly improved through this treatment.

Models shown in Fig. 3 are those of a patient 8½ years of age. This case was started in November, 1939, and was completed in March, 1941. On checking her radiographs we found that all permanent teeth were present and that they appeared normal in their development. This case, even though the molar relation was about normal, was treated like a case of distoclusion, or Class II. There were a narrowness and protrusion of the upper arch, a narrowness and lack of space for second premolars in the lower arch.

The first permanent molars were banded and half round tubes were attached to the lingual of the bands. The usual lingual arch was constructed, using half round posts for attachment to the bands by fitting in the half round tubes.[3] On both lingual arches we soldered stabilizer wires of 0.020 inch thickness between the cuspid and first premolars.[4] On the upper lingual arch we soldered horizontal posterior-recurved auxiliary springs on each side to get expansion in



Fig. 3.

the premolar and cuspid regions. The gauge of these springs was 0.020. Lock wires, 0.022, were soldered anterior to the half round posts in order to lock the appliance in place. On the lower lingual appliance inclined single-coiled loop springs were soldered on each side of the arch.[5] These springs were placed and adjusted so as to bring pressure against the first premolars in order to move them anteriorly and make room for the second premolars. The size of these loop springs was 0.020. Lock wires, 0.022, were soldered anterior to the half round posts in order to lock the appliance in place.

On the buccal of the molar bands we soldered round tubes. The tubes were perpendicular to the long axis of the molars. The upper labial was constructed so that it stood buccally away from the premolar and cuspid region. The loop spring stops attached to the labial appliance were adjusted so that pressure was brought to bear in a posterior direction on the maxillary anterior teeth when appliances were tied into the buccal tubes. Intermaxillary hooks were placed perpendicularly on the upper labial appliance at the cuspid regions. The lower labial appliance was constructed as the upper with the exception that no hooks were attached and that coiled-springs were used on the labial appliance between the loop spring stops and the buccal tube. By tying up all four of the mandibular anterior teeth to the labial appliance, pressure was brought to bear on the anterior teeth which tended to move them forward. Intermaxillary rubber bands were also worn night and day to help stimulate the mandible and to bring the maxillary anterior teeth into their proper relation. The patient was very cooperative, and we were able to obtain a nice result. On completion of the case we had her third molars x-rayed and found mandibular impactions present. We had these removed within a month after the completion of the case.

The models shown in Fig. 4 are those of a boy 11 years of age. The case was started in January, 1940. The dental radiographs indicated that all permanent teeth were present, and they were normal in their development. In this case where a distal relation was present, with irregularity of maxillary and mandibular anterior teeth and narrowness in premolar regions, we used the Oliver occlusal guide plane[6] on the maxillary teeth rather than the regular upper lingual. This occlusal guide plane should not be confused with the horizontal mesio-inclined guide plane or bite stop used in Fig. 2. All four first permanent molars were banded. Half round tubes were placed on the lingual of the bands, and lingual appliances were constructed. Stabilizers of 0.020 wire were soldered to the lingual arches between the cuspids and first premolars. Horizontal posterior-recurved auxiliary springs were soldered on both sides of the upper and lower lingual appliances.[7] On the upper, the occlusal guide plane was constructed in order to bring the mandible into its proper relation with the maxilla. The usual labial appliances were constructed as in Fig. 1.[8] Intermaxillary hooks were soldered on the upper labial at the cuspid regions. After the labial appliances were placed in the buccal tubes, steel ligating wires were used to tie the maxillary lateral incisors to the labial appliance in order to move them forward. The mandibular lateral incisors were also ligated to the lower labial appliance. Intermaxillary rubber bands were worn from the posterior of the lower labial appliance to the intermaxillary hooks on the upper labial appliance. We kept the occlusal guide plane in place with the rest of the labio-lingual appliances



Fig. 4.

for about a year. At this time the jaw relation had been corrected and the premolars had settled into their proper place. We then removed the occlusal guide plane and replaced it with an upper lingual. We retained this type of appliance on the boy until July of 1941 when we removed the appliances. We have been observing him since. The jaw relation is still correct and his anterior teeth are still in good alignment.

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3. Idem: Ibid., Chapter 12.
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2121 HIGHLAND AVENUE

USE OF THE GUIDE PLANE

ANTHONY G. MILLER, D.D.S., F.I.C.D., WASHINGTON, D. C.

TWO cases treated by means of the guide plane, as advocated by Dr. Oren A. Oliver, are presented.

CASE 1 (No. 3).—Girl, aged 12 years 8 months, Class II, division 1, had considerable deep overbite with narrow tapering arches. The case was treated by means of a guide plane with attached auxillary springs obtaining expansion of the arches at the same time.

Fig. 1.



Fig. 2.



Fig. 1, the full face and profile views before treatment, shows collapse of bite, receding chin, and loss of facial height. Fig. 2, the full face and

Presented as part of the "Labio-Lingual Technic" Clinic at the Pan-American Meeting of the American Association of Orthodontists in New Orleans, 1942.

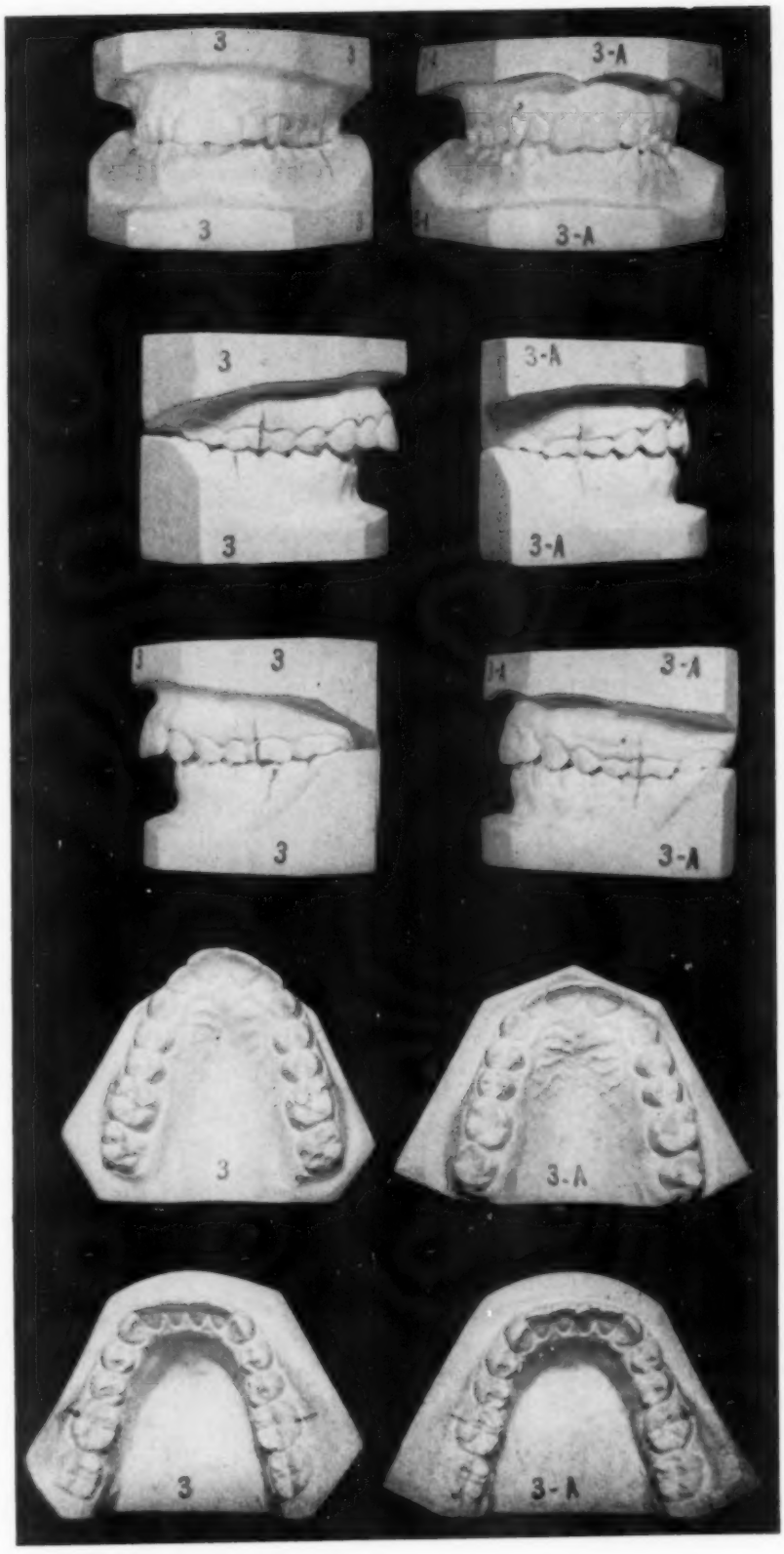


Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

Fig. 7.

profile views after treatment, shows increase of the facial height, development and forward position of the chin.

Fig. 3 shows the frontal view of cast No. 3 before treatment and cast No. 3-A after treatment; Fig. 4, the right lateral view of cast No. 3 before treatment and cast No. 3-A after treatment; and Fig. 5, the left lateral view of cast No. 3 before treatment and cast No. 3-A after treatment.

In Fig. 6 the occlusal view of upper cast No. 3 before treatment and cast No. 3-A after treatment is presented; in Fig. 7 the occlusal view of lower cast No. 3 before treatment and cast No. 3-A after treatment.



Fig. 8.



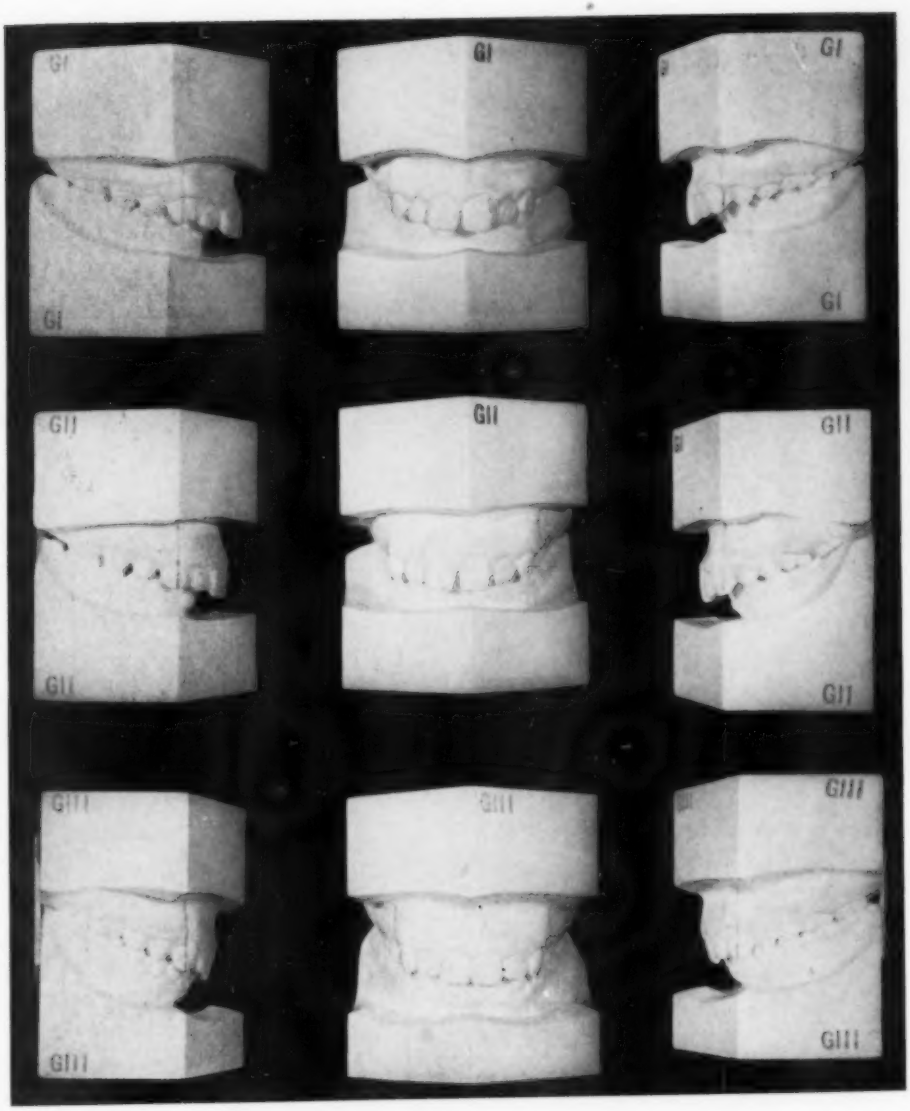
Fig. 9.

CASE 2 (No. G-I).—Boy, aged 13 years, had unilateral distoclusion of the left side, neutroclusion of the right side (by gnathostatic diagnosis), with a missing maxillary right six-year molar, the twelve-year molar having drifted forward. The initial treatment consisted of correction of the distoclusion of the left side only by means of a labial arch and intermaxillary elastics, plain on right side and coil on left side to drive back. This was done until the orbital plane bisected both superior cuspids. At this time the guide plane was inserted bringing the mandible forward, and the teeth into interdigitation and occlusion.

Fig. 10.

Fig. 11.

Fig. 12.



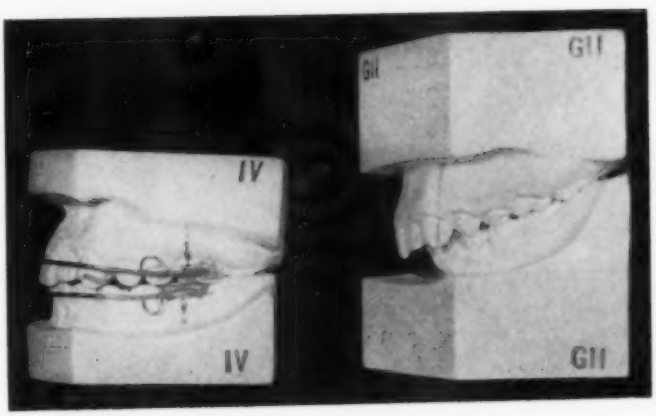


Fig. 13.

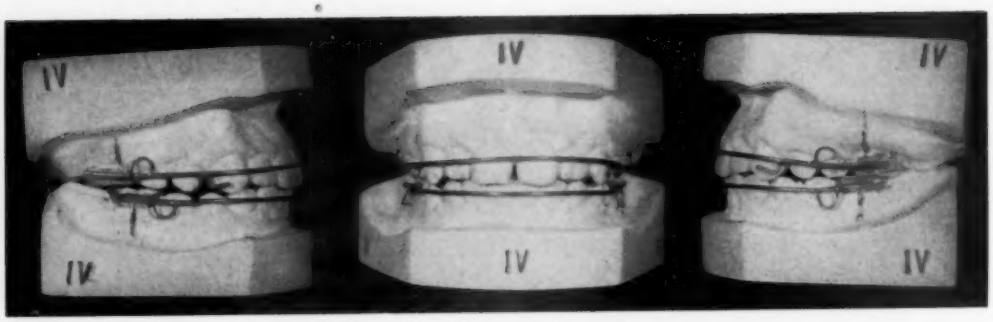


Fig. 14.

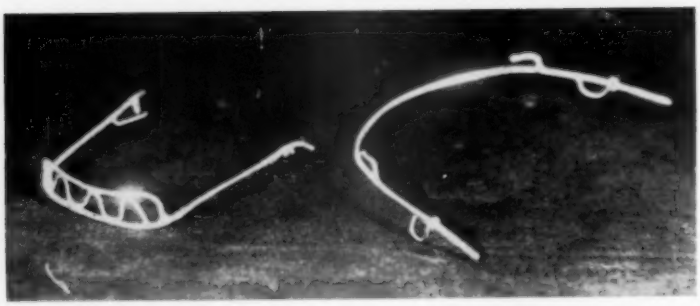


Fig. 15.



Fig. 16.



Fig. 17.

Fig. 8 is the full face and profile views, before treatment, showing collapse of bite, receding chin, and loss of facial height. Fig. 9 is the full face and profile views after treatment, showing increase in facial height, development and forward position of the chin.

Fig. 10, cast G-I, shows the frontal, right and left lateral views, before treatment. Fig. 11, cast G-II, shows the frontal, right and left lateral views, at the time of correction of the left distoclusion only, showing the orbital plane bisecting the superior cuspids. Fig. 12, cast G-III, shows the frontal, right and left lateral views, after treatment.

Fig. 13, cast G-II, shows the left lateral view, before guide plane was inserted, and the appliance cast IV, with appliances and guide plane in place. The teeth are in their proper relationship and interdigitation is not complete. Fig. 14, cast IV, shows the frontal, right and lateral views of labial appliances, and Fig. 15 the superior labial arch and guide plane. Fig. 16 shows the lingual view of the guide plane in place, and Fig. 17 the occlusal view of the guide plane and lower appliances.

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Erratum

In the article "Mechanical Orthodontics, a Halfway Measure" by Alfred P. Rogers, which appeared in the February, 1943, issue of the Journal, the last two lines on page 102 (beginning with the words *Adjusting interferences*) and the first fifteen lines on page 103 (ending with the words *treated as long as improvement continues*) are out of place and should be transferred to the last line on page 103 and inserted after the word "manner." This transferred material should begin a new paragraph, followed by the remainder of the last line on page 103.

PROGRESSIVE CLINICS ON THE EDGEWISE ARCH MECHANISM IN ACCORDANCE WITH THE PHILOSOPHY AND TECHNIQUE OF DR. CHARLES H. TWEED

I. Preliminary Arch Set-Up and Reduction of Excessive Protrusion of the Maxillary Incisors, Allen Collins, D.D.S.

II. Anchorage Preparation, Robert E. Coleman, D.D.S.

III. A Headcap for Extraoral Anchorage, Homer M. Shelden, D.D.S.

IV. En Masse Movement to Correct Jaw Relationships, Louis Braun, D.D.S.

V. Detailed Positioning of Teeth Prior to Retention, and Retention of Class II, Division 1 Cases, F. Copeland Shelden, D.D.S.

I. PRELIMINARY ARCH SET-UP AND REDUCTION OF EXCESSIVE PROTRUSION OF THE MAXILLARY INCISORS

Allen Collins, D.D.S., Detroit, Mich.

DR. LEWIS has presented the basic principles of the Tweed philosophy of treatment.* It has been proved that the proper preparation of stationary anchorage in the mandibular arch and the intelligent use of this prepared anchorage will more than repay the operator in the end results obtained.

The first stage of treatment is divided into two parts:

1. Anchorage preparation in the mandibular arch.

2. Rearranging of axial inclinations in the maxillary arch, especially in the incisal segment.

Before proceeding to the arch wire manipulations, please bear in mind the fundamental objectives of treatment, which are:

1. To so position all teeth in the mandibular arch that they will be able to afford resistance mechanically to forward displacement.

2. To so change the inclination of abnormally tipped maxillary incisors that they will offer less resistance to distal mass movement.

The preparation of stationary anchorage means that the mandibular incisors must be placed on their basal bone in a position of mechanical functional balance, or on basal bone exhibiting an inclination varying from a minus five lingual to a plus five labial inclination.

Coupled with the placement of the incisors on basal bone, the teeth in the buccal segment are first uprighted, then tipped into distal axial inclination. The buccal segment will also be torqued, so that the crowns will all exhibit lingual inclination.

Delivered before the Symposium on Treatment of Class II Malocclusion at the Meeting of the American Association of Orthodontists, New Orleans, March 16 to 20, 1942.

*Lewis, Samuel J.: Treatment of Class II, Division 1 Malocclusion by Means of the Edgewise Arch Mechanism (part of A.A.O. Symposium on Treatment of Dentofacial Anomalies), Am. J. Orthodontics and Oral Surg. 28: 689, November, 1942.

When the teeth in the mandibular arch are placed in their proper positions, a 0.021 by 0.028 inch stabilizing arch wire tied in tight from molar to molar will give the operator a powerful, dynamic unit of stationary anchorage.

All teeth in the maxillary and mandibular arches, with the exception of the maxillary incisors, are fitted with bands.

Each band carries an edgewise bracket and staples soldered mesially and distally to the centrally placed bracket.

The first molar, or whenever possible the second molar, band carries a 0.022 by 0.028 inch rectangular tube soldered on its buccal surface.

After all the bands are cemented to place and checked for stability, a 0.016 inch round arch wire is inserted in both the maxillary and mandibular arches.

This 0.016 inch wire will have a fairly flat anterior segment and very wide buccal segments, and the ends are bent gingivally and lingually (Fig. 1).

The tying in of these 0.016 inch arch wires will initiate tooth movements with as little pain and discomfort to the patient as possible.

The tooth movements that will be initiated are as follows:

1. Uprighting the molar teeth.
2. Lining up the occlusal variations of the buccal teeth.
3. Depression and lingual movement of the incisors.

In two weeks, or when the discomfort occasioned by the initial tooth movements has stopped, the patient is ready for the next step.

A 0.020 inch round arch wire is fashioned for the mandibular arch. This wire will have a fairly flat anterior segment, but not so much width in the buccal segments as in the 0.016 inch wire. The molar tip-back (gingival) bend is increased.

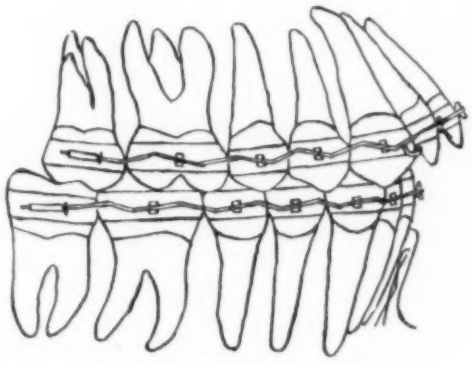


Fig. 1.

A loop stop or a tie spur is placed ⅛ inch mesial to the buccal sheath. This arch wire is then tied into the mandibular arch, and will continue the work done by the 0.016 inch wire.

The maxillary arch is treated differently. A 0.021 inch round arch wire is fashioned with vertical spring loops placed between the cuspid in first deciduous molar teeth.

Mild tip-back bends are placed in the buccal segments, with enough tip-back bend in the molar teeth so that they will resist forward displacement when the vertical loops are activated.

Check the arch wire for symmetry and arch form on the modified Bonwill-Hawley chart.

Four long spurs are soldered to the anterior segment of this wire and their ends are bent over the incisal edge of the maxillary incisors (Fig. 2).

These spurs act in two ways:

1. They exert pressure on the labioincisal angle of the teeth, causing lingual movement of the crowns without disturbing the apices.

2. They prevent the arch wire from creeping gingivally, and so prevent elongation of the maxillary incisors.

The vertical spring loops are activated in the following manner. A spur is soldered mesial to the molar sheath. By tying around the molar sheath and pulling up tight, the vertical loop is opened to the desired degree.

After the loop has been opened, the wire is tied into the brackets of the rest of the buccal segment.

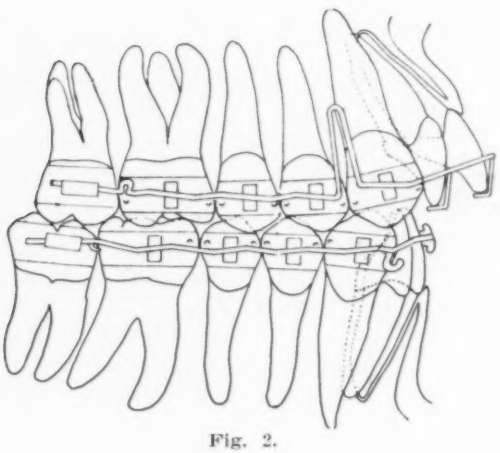


Fig. 2.

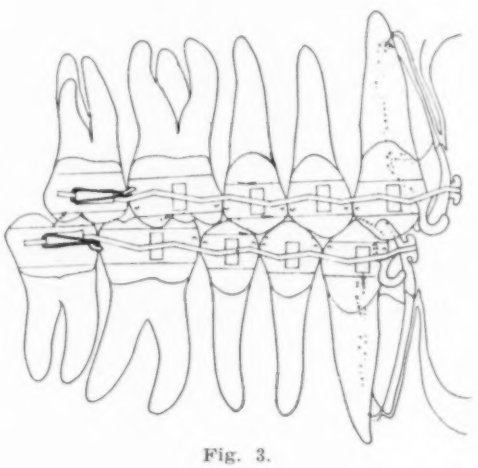


Fig. 3.

At subsequent visits further activation of the vertical loops is obtained: (1) By untying the buccal segments and pinching the loop back to its original shape, because some resiliency may be lost, owing to initial adjustments. (2) By tying around the molar sheath until the loop is opened to the desired degree, and retying the buccal segment.

In a period varying from four to eight weeks the maxillary incisors will be moved far enough lingually so that all spaces will be closed (Fig. 3). We are then ready for the next stage in treatment, which Dr. Coleman will demonstrate.

II. ANCHORAGE PREPARATION

ROBERT E. COLEMAN, B.S., M.S., D.D.S., DETROIT, MICH.

DR. COLLINS has demonstrated the application of the initial arch wires. As soon as all the interdental spaces have been closed and the protrusion of the anteriors has been greatly reduced (Fig. 1), we go on to our next step—anchorage preparation.

In anchorage preparation our primary objective is to obtain the greatest possible amount of intraoral anchorage. To accomplish this end we believe it absolutely necessary that the mandibular incisor teeth be positioned upright on the basal bone and that the teeth in the buccal segments be tipped distally in order to establish a strong toe-hold. Every unit in the mandibular arch must be coordinated in order to resist a forward displacement of the teeth under Class II mechanics. Fig. 2 is a diagrammatic drawing showing anchorage preparation by distal en masse movement of the mandibular teeth.

It is my privilege to demonstrate just how we go about establishing this toe-hold or anchorage preparation.

At about the third visit of the patient, we insert into the buccal tubes and brackets of the mandibular teeth a resilient 0.021 by 0.025 inch stainless steel (working) arch wire, carefully fashioned to the modified Bonwill-Hawley chart, as demonstrated by Dr. Lewis. Scratch marks are made with a sharp-edged instrument on the buccal aspect of the arch wire midway between the central incisors, mesial and distal to all the brackets except those on the incisor teeth and $\frac{1}{16}$ inch mesial to the molar sheath. The arch wire is then removed for the placing of the second-order bends and torque.

Mild second-order or tip-back bends are incorporated by grasping the arch wire in the square-beaked pliers from the lingual, just mesial to the scratch mark in front of the buccal tube, and bending the distal portion of the wire gingivally. This process imparts a tip-back to the second molar. Now move the pliers to the distal mark of the first molar bracket and bend the distal portion, this time occlusally, one width of the pliers distal to this mark. Next grasp the arch wire just mesial to the mesial mark and bend gingivally. We have now made a tip-back bend for the first molar.

Second-order bends for the premolars and canines are made similarly by bending occlusally, one width of the pliers, distal to the distal bracket mark and gingivally, one width of the pliers mesial to the mesial bracket mark. All the second-order bends should be of equal and of moderate degree, approximately 20 degrees. The side receiving these bends is now below the original plane of the arch wire. A correctional bend to raise this segment is made by bending it occlusally, one width of the pliers, mesial to the previously placed gingival bend mesial of the cuspid.

This procedure is repeated for the opposite buccal segment. The heels, or portion of the arch wire fitting into the buccal tubes, are bent slightly lingually

to prevent an indesirable rotation of the molars, and their tip-back bend is also increased for greater stability for this anchor tooth.

The arch wire is returned to place in the mouth and checked for accuracy. Scratch marks are made immediately anterior to the bucal tubes before the arch wire is again removed. Lingual crown torque of a mild degree, to coordinate with the mild second-order bends, is placed in the incisal and bucal segments by the use of either two pliers or two torquing irons.

The incisal torque may be placed first. Hold the arch wire from the lingual with the torquing iron or pliers in the left hand (Fig. 3) at the correctional bend mesial to the right canine, and with the second torquing iron, mesial to the first. Rotate occlusally slightly until the long axis of the iron is parallel to the planes formed by the second-order bends. We should now have the incisal segment torqued to coordinate with the second-order bends in the right bucal segment. This torquing action, however, has displaced the left bucal segment gingivally from its normal plane. A compensating bend is made by grasping the torqued incisal segment mesial to the left correctional area with the torquing iron in the left hand, and rotating gingivally with the second iron or pliers placed in the correctional area until the left bucal segment rises to the same plane as that of the right segment. The incisal torque is then coordinated to the same degree as the second-order bend in the posterior segments (Fig. 4).

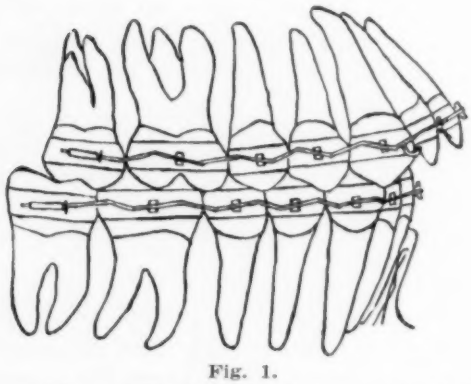


Fig. 1.

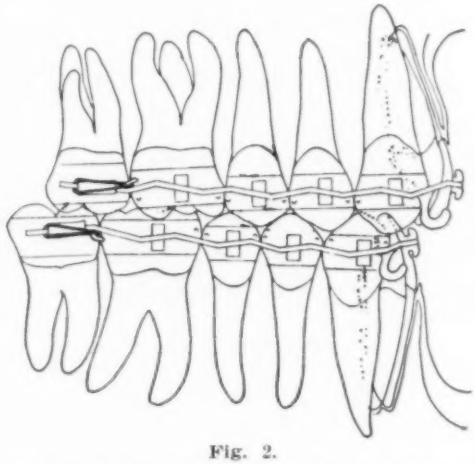


Fig. 2.

Fig. 1.—The interdental spaces have been closed and the protrusion of the anteriors has been greatly reduced.

Fig. 2.—Anchorage preparation completed in the mandibular arch, and excessive axial inclination of the maxillary incisors corrected.



Fig. 3.—Anterior segment of mandibular arch wire.

Lingual crown torque is then incorporated into each bucal segment by holding the arch wire in the correctional or dead area and rotating the bucal segment slightly occlusally to the same degree as in the incisal segment.

Intermaxillary elastic hooks for Class III elasties are soldered on the arch wire mesial to the canine brackets and T stops or spurs are soldered just mesial to the bucal tubes. Attachments are of 0.028 inch brass ligature wire. The

arch wire is checked for symmetry on the Bonwill-Hawley chart before being returned to the mouth. If accurate, it is ligated to place. Torquing and arch-seating irons are sometimes necessary in order to seat the arch wire properly into the brackets. A strong tie-back force is applied to the ligature around the molar sheath.

During the same visit, or within a few days, a stabilizing 0.021 by 0.028 inch upper arch wire is placed to maintain anchorage in the maxillary arch and to prevent a mesial movement of the teeth when Class III elastics are used. A headgear exerting a distal pull on the whole maxillary unit is worn at night further to prevent any mesial migration of the maxillary denture. Heavier Class III intermaxillary elastics are worn with the headgear.

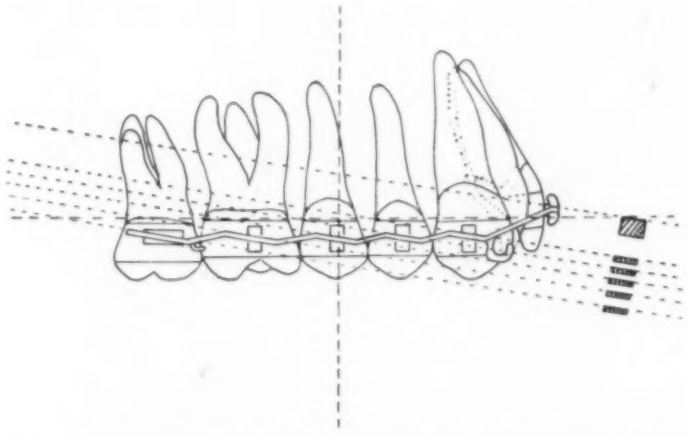


Fig. 4.—Correct coordinated second-order bends with incisal torque.

If the maxillary incisors have not been banded, they are banded at this point. The 0.021 by 0.028 inch arch wire is fashioned to the modified Bonwill-Hawley chart. Mild second-order bends and torque are imparted to the arch wire, as for the mandibular one. Intermaxillary elastic hooks and T stops or spurs are likewise soldered to place. The arch wire is then seated and ligated.

The next step, the construction and application of the headgear, will be demonstrated by Dr. Homer Shelden.

308 David Whitney Building

III. A HEADCAP FOR EXTRAORAL ANCHORAGE

HOMER M. SHELDEN, D.D.S., KANSAS CITY, MO.

THE headcap illustrated in Fig. 1 is used for anchorage, not for moving the teeth, in accordance with a technique advocated by Dr. Charles H. Tweed.

As explained in the previous clinics, when Class III rubbers are worn for the distal tipping or moving of the mandibular teeth, a headcap is worn at night. It is attached to the maxillary arch, maintaining a distal pull to offset the mesial pull of the rubbers.

The cap is constructed of a woman's hair net, to which is sewed a 1½-inch heavy ribbon, reinforced on the under side with mercerized dress belting one inch wide.



Fig. 1.

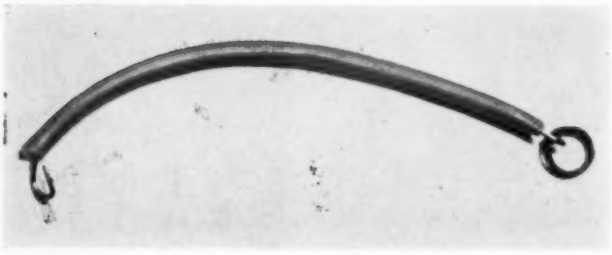


Fig. 2.

The side metal attachment is made of 0.040 inch steel wire, as shown in Fig. 2, and is curved to the contour of the child's face, care being taken to avoid irritation at the corners of the mouth. The anterior portion is looped to attach

to a small hook on the maxillary arch just mesial to the cuspid bracket. The distal end is bent back to form a loop, over which a small rubber ligature is hooked. It is then carried distal and attached to a dress hook, so placed on the cap as to create a distal pull a little greater than the Class III rubbers on the maxillary arch.

The steel wire is covered with a small intravenous rubber tubing to protect the child's face.

I have found this type of headcap advantageous, for a direct distal pull is obtained and the application of pressure by the rubber ligatures can be varied.

The next stage of treatment will be demonstrated by Dr. Louis Braun.

6243 Brookside Road

IV. EN MASSE MOVEMENT TO CORRECT JAW RELATIONSHIPS

LOUIS BRAUN, D.D.S., DETROIT, MICH.

THE previous clinics have taken you through the various steps of treatment leading up to the completion of the first stage of our major objectives in treatment; namely, the establishment of correct anchorage in the mandibular arch and the breaking down of resistance to distal movement in the maxillary arch.

The mandibular teeth are now in their correct relation to the basal bone and all rotations have been corrected. The incisors have been depressed slightly into thicker alveolar bone for greater support, incidentally relieving the trauma on the maxillary gingival tissues, and have been inclined lingually to offer greater mechanical advantage toward resisting labial tipping when Class II elastics are worn (Fig. 1).

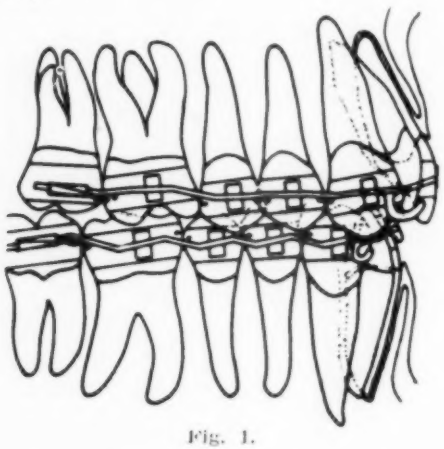


Fig. 1.

The mandibular posterior teeth have a distal and lingual axial inclination which gives them greater mechanical advantage to resist forward displacement when the Class II elastics are worn. The roentgenograms taken at this time will often show a marked hypercalcification of the alveolar bone on the mesial side of these teeth, thus increasing the support and stability against forward displacement when the Class II elastics are worn.

The maxillary arch has been expanded in harmony with the mandibular arch, and some or all of the rotations have been corrected. The axial inclination of the incisors has been altered to break down the resistance to distal movement. The posterior segments have their teeth in slight distal and lingual axial inclination.

Our objective now is to place the maxillary teeth in correct relation to their basal bone and to correct the relationships of arch and jaw to each other and to cranial anatomy.

The mandibular arch is next prepared for dynamic mass anchorage. A stabilizing 0.021 by 0.028 inch steel arch wire is fashioned in the modified ideal

form, incorporating the same type and degree of bends and torque as the resilient 0.021 by 0.025 inch arch wire just removed. These bends and torque may be slightly accentuated before inserting. Tie-back hooks or spurs are placed about $\frac{1}{16}$ of an inch anterior to the rectangular sheaths. Strong steel ligatures from these hooks to the distal of the rectangular tubes bind the teeth firmly in a unified dynamic mass anchorage.

In the maxillary arch, a resilient 0.021 by 0.025 inch steel arch wire is used. A modified ideal arch wire is fashioned, mild coordinated tip-back bends are incorporated from the canines back, and synchronized mass lingual torque is inserted into the incisal segment. Lingual torque is added to the posterior segments and the tip-back bends and lingual torque are slightly increased in the ends of the wire, which are inserted into the rectangular sheaths, thus tending slightly to increase the tip-back of these teeth.

Tie-back hooks or spurs are placed just anterior to the rectangular sheaths, and intermaxillary hooks are placed anterior to the canines. The arch wire is tied back to the distal of the sheaths and is seated in all brackets. Intermaxillary elastics are used in the regular Class II manner.

In obtaining en masse distal movement of the maxillary teeth, it is necessary to proceed with caution, following the same principles in appliance adjustment as are used in obtaining correct positioning of the mandibular teeth. Very mild second-order bends and torque are used at first but are gradually increased at intervals of two or three weeks. It is necessary to use new resilient 0.021 by 0.025 inch arch wires to maintain resilient activation in the appliances and to obtain sufficient arch length for correct positioning of the teeth. Light intermaxillary elastics are worn at first and gradually increased to heavy ones.

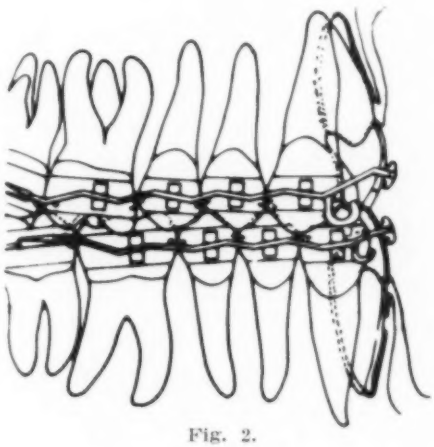


Fig. 2.

At each visit the mandibular anchorage should be thoroughly checked to determine if there is a weakening of the anchorage units. If so, the mandibular arch wire is removed, and the bends and torque are increased at these units.

Every time the arch wires are removed, they should be checked with the arch graphs for coordination and symmetry before reinserting. About once in six weeks the mandibular arch wire should be removed and checked with the arch graph. The bands should also be inspected.

Intermaxillary elastics are worn continuously until the incisors are biting edge to edge and are then discontinued for about two weeks, to make certain that there has been sufficient en masse movement of the maxillary teeth. If there has not been enough movement to hold them, the treatment is continued as before. If the movement has been satisfactory, elastics are again used until the incisors are biting edge to edge (Fig. 2).

The case is now ready for the third and final stage in our major objectives; that is, detailed positioning of the teeth for arch form and esthetics in preparation for retention.

This procedure will be discussed and demonstrated by the next clinician.

1601 David Whitney Building

V. DETAILED POSITIONING OF TEETH PRIOR TO RETENTION, AND RETENTION OF CLASS II, DIVISION 1 CASES

F. Copeland Shelden, D.D.S., Kansas City, Mo.

MOST of us agree, I am sure, that nature will take the final hand in finishing any orthodontically corrected malocclusion. However, certain steps may be taken to aid nature in her task, which, if omitted, may well account for failure as time goes on.

The finishing arch wires should be fashioned carefully of 0.021 by 0.025 inch steel. Though the Bonwill-Hawley arch form may still be used as a partial guide, these arch wires may be slightly narrower than the working arch wires. In these wires all tip-back bends and torque used in previous arch wires are incorporated.

As the case nears completion, it often happens that the cusps of the maxillary and mandibular premolars are not seated when the jaws are closed. This step should be accomplished, before the appliance is removed, by placing spurs gingivally on each arch wire and then lacing a rubber ligature around these spurs (Fig. 1). If this method is used, a slightly accentuated curve of Spee should be placed in the upper arch wire. A second method is to split the arch wires between the first premolar and cuspid, turning the ends of the arch wires gingivally, mesial to the first premolar and distal to the molar tubes, and placing a rubber ligature, boxlike, around the four ends (Fig. 2).

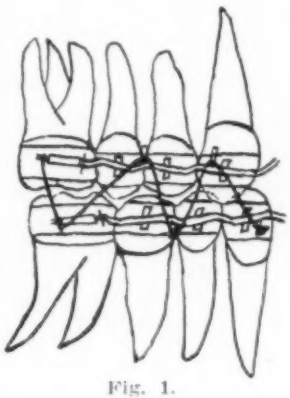


Fig. 1.

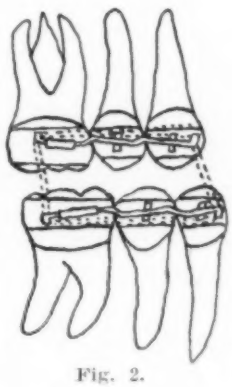


Fig. 2.

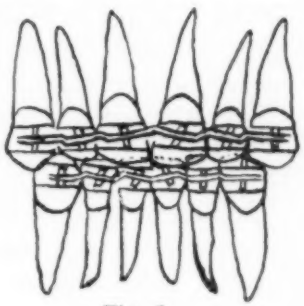


Fig. 3.

Along with the correction of the malocclusion it is our obligation to place the individual teeth in the most esthetically pleasing positions. We therefore fashion the finishing arch wire so that the crowns of the four maxillary and four mandibular incisors converge toward the median line and the roots away from the median line. It is accomplished quite simply by placing tip bends in the arch wires in the region of each anterior bracket, placing them so that the roots will be thrown away from the median line (Fig. 3). In so doing we not only accomplish our esthetic purpose but also place the roots on a larger arc of a circle than the crowns, which is the most stable functional position.

Retention is accomplished in the maxillary arch by placing a Hawley plate, with labial wire from cuspid to cuspid. The plate also carries a bite plane. A Hawley retainer is also placed in the mandibular arch, with occlusal rests on the first molars and labial wire from cuspid to cuspid.

315 Alameda Road

Editorials

To the Members of the American Association of Orthodontists, Greetings:

In the AMERICAN JOURNAL OF ORTHODONTICS AND ORAL SURGERY you will have read the notice that the Annual Meeting of our Association scheduled for May 3, 4, 5, and 6, 1943, in Chicago has been cancelled. Cancellation was the expressed judgment of a majority of our members, as determined from the questionnaire sent out some time earlier. All did not vote, but of those who did three to one were in favor of cancellation. One hundred sixty-five members expressed a determination to attend the meeting if held. This would have been a fair attendance for these times, but a survey of the locations represented by the returned cards showed that this attendance would have constituted a more or less local representation. Our Association is a national organization and has always had a national representation at its meetings. Your officers feel that in carrying out the expressed wishes of the majority of our members by cancellation of the 1943 meeting, they also acted in the best interest of the American Association of Orthodontists by paying respect to our country's needs in this war emergency.

This cancellation will mean a sacrifice for all our members, as our meetings have always been of considerable scientific interest, as well as a source of good fellowship and an exchange of ideas for the betterment of both our Association and its service to the public. However, we must not let this break in our scheduled meeting be a break also in our interest for the advancement of the science of orthodontics. Those of us who do not enter directly into armed services of our country can help strengthen our defenses by a further accumulation of scientific knowledge and an improvement of our operative techniques, to pass on to the boys when they come back again to take their places in civil life and practice. May they come back soon with their faces shining with victory and a job well done. They have made the real sacrifice, and we must do our utmost to keep the home fires burning. In furtherance of this it is thought advisable to encourage the separate sectional societies to carry on with essay and clinic meetings in their local areas where extensive travel facilities are not involved.

Most of the orthodontists in the service are doing general dentistry. However, in a letter Brigadier General R. H. Mills writes me as follows, "It is felt that orthodontists can be of valuable service in the treatment of facial injuries." He therefore recognizes the value of the special training of the orthodontist in this field, and I think will do what he can to have them placed where their training and experience will be of greatest service to their country.

The American Board of Orthodontics usually holds its examination just prior to the regular meeting of the American Association of Orthodontists. This Board is free to hold its examination whenever there is a sufficient number of

applicants to justify a special meeting of the Board. It seems unlikely, however, that the need will arise at this time.

The awarding of the Ketcham Memorial is strictly a function of general assembly of the American Association of Orthodontists and should wait for a regularly scheduled meeting, although a recipient may be chosen for each year if such a plan is thought advisable. The real significance of the Ketcham Memorial award is brought out by its presentation before the general assembly.

In voting three to one in favor of the cancellation of the 1943 meeting of our Association it seems you have frozen all officers, board of directors, and committees in office until the next regular meeting. Our constitution and by-laws leave no alternative. The end of the war emergency or a demand from the membership of the Association will determine when the next regular meeting will be held, as provided for in Chapter IX, Section 3, of the by-laws.

During the Mid-Winter Meeting of the Chicago Dental Society on Feb. 22, 1943, at an informal luncheon of the Ad Interim Committee, the future plans of our Association were discussed with members of the American Association of Orthodontists in attendance.

The reading of the Honor Roll of the American Association of Orthodontists included forty-five of our members. This honor roll will be published in the JOURNAL.

Dr. James W. Ford, Chairman of the Program Committee, reported that he had experienced difficulty in securing commitments for papers and essays for the 1943 meeting because of the uncertainty of the war times but that any papers in process of preparation would be welcomed by the publishers of the AMERICAN JOURNAL OF ORTHODONTICS AND ORAL SURGERY or they may be held over for the program of the next regular meeting.

Dr. Allan G. Brodie, Chairman of the Research Committee, reported receiving a number of manuscripts entered for the Research Award. In view of the uncertainty of the next meeting of the American Association of Orthodontists our plans had to be changed. In order to avoid penalizing the authors of the papers already submitted and to encourage the continuance of the good work, contestants have been given permission to publish their articles in suitable journals without prejudice to their rights in the Research Award.

At a formal meeting later of the Ad Interim Committee, all present except President-Elect Dr. Archie B. Brusse, the Secretary-Treasurer reported our finances in good order. We have 687 members in good standing; twenty-five are new members since the New Orleans meeting.

Certain expenses of our Association will be eliminated by the cancellation of the 1943 meeting, but it was thought advisable to continue the dues for the coming year to furnish additional funds against possible demands of these war times and continue our subscriptions to the AMERICAN JOURNAL OF ORTHODONTICS AND ORAL SURGERY. The dues of the members in the armed services are remitted.

With the spirit of VICTORY always before us, let us all work for an early termination of this world conflict.

J. A. BURRILL, President,
American Association of
Orthodontists.

Progress and School Conflict

The specialty of orthodontics is attracting wide attention in the medical profession; however not from the standpoint of treatment, but rather from the standpoint of etiology and symptoms. The teeth and dental arch are now routinely examined for the reflection of endocrine symptoms, for racial and family traits, for metabolic disturbances, for diseases due to lack of vitamin D and many other symptoms now attracting attention in medical literature and that also tie in with the present orthodontic trend or attitude toward the jaws, teeth, and mucous membrane.

Orthodontists, too, are viewing their specialty in a broader perspective than in the past. This may be another reason why so many men are seemingly eager to change "after school" orthodontic routine, so that they can give more thought, time, and application to the precision treatment of cases. If you should ask any orthodontist with over ten years' experience what has been the greatest handicap that he has experienced in his practice of providing the best orthodontic service of which he is capable, he would no doubt tell you that it is the lack of sufficient time available for the modern child—time without school conflict in which to receive his services. It is difficult to render careful painstaking services if the time for rendering such service is limited to after school hours and Saturday mornings. A total operative time of fourteen to sixteen hours a week does not fit in with painstaking treatment urgent for the problem in hand; neither does this square with the social and economic phase of the problem.

If letters received from professional men and organizations may be taken as a criterion, the subject of the conflict of school hours of children with health service takes one of the top-ranking places in reader interest in this JOURNAL. Obviously orthodontists, as a group, are so much interested in this subject because they are given the task of correcting a complex malocclusion, and at the same time are told that the child must not miss any school; this is analogous to telling the orthodontist that he is expected to correct a condition that will require many months of treatment, yet he will be able to see the patient only on a catch-as-catch-can basis.

To this situation orthodontists react in one of two ways: either they take the line of least resistance and resort to the system of "queue up after school; first come, first served" or they adhere to a formal appointment routine, as has been immortalized in precision dental practice for ages, and insist that children be excused from school for visits when necessary during treatment. There can be little doubt that this latter routine meets with formidable resistance from school authorities, in many localities at least; it also places the patient in an unpleasant situation that penalizes his grades in school.

Because of the wide interest in this problem, an excerpt pertaining to the subject, by Dr. Wallace Sorrells, former chairman of the Public Information Committee of the A.A.O., is reprinted here. The original text appeared in the first quarter issue for 1943 of the *Journal of Dentistry for Children*. It again reinforces the contention of many that something constructive can be done to

improve this unfortunate school conflict situation when its full importance is well understood by all parties involved.

Before the outbreak of the war, many thoughtful and farsighted people in the teaching, medical, and dental professions had come to realize something had to be done toward breaking down the barrier of school attendance in the interest of the children's health. The limitations placed on transportation and other things to help solve problems arising from war have greatly aggravated this already bad situation.

Doctors will now be compelled to give patients coming from distant points more time when they call in an effort to accomplish the greatest possible results consistent with safe and sound scientific treatment in order to compromise with the limitations placed upon travel. This makes it a difficult matter for doctors to assign patients time and expect to follow out any schedule.

The State of California has perhaps done more toward this need than any other state. In 1935, it enacted legislation authorizing children to be excused from school for bona fide medical and dental appointments without penalty to the child. The text of the bill specifically provides that no absence of a pupil from school for this purpose shall be deemed an absence in computing daily attendance records.

During more recent times, some state and local dental societies have taken progressive steps in an effort to effect a modification of the regulations governing school attendance. Naturally, more serious conditions exist in the cities where distance, time, and transportation problems complicate the situation.

Among the cities which have made an earnest effort to solve this problem are Oklahoma City, Oklahoma, and Kansas City, Missouri. In these cities, joint committees, composed of representatives of the medical and the dental societies and school officials have modified the rules and regulations governing school attendance to provide a more orderly and cooperative system of operation.

The rules and regulations in Oklahoma City for observance are as follows:

(a) That all school children needing the services of a doctor should be encouraged to secure the service.

(b) That an absence of one-half day should not be recorded where an appointment for medical or dental treatment has been kept.

(c) That absence due to illness or to keeping appointments with doctors should receive no penalty.

(d) That written requests from the parents be presented to the school:

1. When the child wishes to leave the building to keep an appointment for medical or dental service.
2. When the child has been to see the doctor before coming to school and wishes to return to class.

(e) That attendance awards should be discontinued.

These simple and effective rules are easy to observe and have relieved practically all the strain and confusion which formerly existed under the high-pressure attendance system. No longer do the children pout and cry, and the teachers, parents and doctors bicker and fuss with each other over the child missing an insignificant amount of time because of an appointment during school hours.

When this policy was announced, a very wholesome and cooperative attitude almost immediately manifested itself and everybody concerned appeared very happy over the arrangement. After its having been in operation for one and one-half years, no one has suggested that any change to the rules be made, and all parties involved seemed to be well-pleased for the working formula.

The Kansas City District Dental Society, in cooperation with the school officials, has agreed upon a tentative working arrangement to help solve this problem. They use the following excuse blank:

EXCUSE FORM FOR DENTAL APPOINTMENT

Approved by Public School Authorities of Kansas City, Missouri.

NAME OF PUPIL _____

has an appointment for necessary dental service on

Date of Appointment _____19____

Time of Appointment _____.

This service cannot be satisfactorily rendered outside of school hours.

_____ D.D.S.

This appointment was arranged with my knowledge and approval.

_____

Signature of parent.

Instructions are printed on the reverse side as follows:

The public school authorities and the dentists of Kansas City are cooperating in a plan to make it possible for the children of our schools to obtain the fundamental health service necessary for their health and well-being.

This excuse form, used judiciously, will enable the school children to obtain the necessary dental service that cannot be satisfactorily rendered outside of school hours.

At present, the Kansas City school officials interpret the general statutes governing school attendance to mean that any child absent from school for more than one-fourth day must be marked absent for the time away, unless on a school mission under supervision of a school representative.

The committee representing the dental society holds that it is the part of any well-formulated health program to teach health subjects objectively. And since all schools operate under health supervision it should not take any stretching of the imagination to recognize any amount of time under one-half day expended with doctors on an excuse, as being a supervised school mission.

If we take into proper consideration all the obstacles now placed in the way, we cannot but logically conclude that one-fourth day does not allow sufficient time. Friendly negotiations are continuing and it is hoped that the Attorney-General will find it possible to place a broader interpretation on the law.

Neither school officials or anybody else can afford to compromise the child's health for the sake of preserving attendance records. Especially, when the pro rata of time off per child means little or nothing insofar as their future intelligence is concerned, and their health means so much.

One of the greatest object lessons on the present war is that we must learn to put first things first if our nation and its institutions are to survive for the benefit of our children.

With all lines of endeavor having to undergo readjustment to better solve our present-day problems, we must not neglect the health of our children by failing to meet our responsibilities in this direction. It is up to the medical and the dental organizations and the school officials to get busy and rationalize school attendance and professional services.

Two methods of approach deserve special consideration:

1. To formulate a program which will encourage parents to determine the treatment requirements of their children immediately following the closure of the school term and have them fulfilled insofar as possible during the vacation period and not postpone it until a week or two before school opens.
2. To modify the rules governing school attendance so children may have a fair and reasonable opportunity to obtain office treatment during school hours without being penalized.

The Public Relations Committee devoted a great deal of attention to this subject during the period that the Public Relations Bureau of the American Association of Orthodontists was functioning. The news that active progress has been made in some districts will be welcome to a host of professional men, many of whom have spent years wrestling with this problem. The Public Relations Committee of the A.A.O. deserves much credit for progress in this field. *H. C. P.*



Honor Roll of Active Members
American Association of Orthodontists
Serving in the Armed Forces

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Little Rock, Ark.
Dr. Walter Appel
Cheyenne, Wyo.
Dr. Richard E. Barnes
Cleveland, Ohio
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St. Louis, Mo.
Dr. Harvey G. Bean
Toronto, Ont., Can.
Dr. J. Victor Benton
Wichita, Kan.
Dr. George F. Bowden
Denver, Colo.
Dr. W. A. Buhner
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Lieut. Col. B. I. Newsom
Lieut. Col. Wm. H. Siefert
Lieut. Col. Richard F. Thompson
Col. L. B. Wright

There may be members in the Service whose names do not appear in the above list. These members should notify the secretary at once so that their names may be included.

Max E. Ernst, Secretary, American Association of Orthodontists, 1250 Lowry Medical Arts Bldg., St. Paul, Minn.

Department of Orthodontic Abstracts and Reviews

Edited by

Dr. J. A. Salzmann, New York City

All communications concerning further information about abstracted material and the acceptance of articles or books for consideration in this department should be addressed to Dr. J. A. Salzmann, 654 Madison Avenue, New York City.

Synopsis of Traumatic Injuries of the Face and Jaws: By Douglas B. Parker, M.D., D.D.S., Associate Professor, Department of Oral Surgery, School of Dental and Oral Surgery, Columbia University. Pp. 334, with 229 illustrations, St. Louis, The C. V. Mosby Company, 1942.

This book is presented as a manual dealing with the early first-aid treatment of face and jaw injuries. It is particularly intended to prepare dentists in basic and emergency surgery for civilian and military emergencies. Parker calls upon his experience in the First World War in France and in nearly thirty years spent as a hospital oral surgeon and in teaching. Facial wounds and jaw injuries are frequent as the results of accidents in civilian life no less than as the result of war combat.

In this book, the author presents an outline of the anatomy of the face and jaws. This section is illustrated with striking photographs and diagrams which make unnecessary the reading of more detailed texts for this purpose. In his chapter on the initial treatment of injuries at the scene of accident the author follows general directions in giving first-aid. While laying great stress on dental injuries, the treatment of shock, the control of infection, and the treatment of wounds are given due consideration.

Burns of the face, which occur more frequently than is generally supposed, are discussed and treatment is presented. The stabilization and handling of bony injuries about the face and jaws are discussed in great detail. The latest types of apparatus employed in treating facial injuries are fully discussed and illustrated. The construction of such apparatus is adequately presented.

Parker has written an exceedingly practical and useful manual, one that will have great value for the practicing dentist at all times, not only during the war but as a peacetime text as well.

Practical Orthodontics: By Martin Dewey and George M. Anderson (Revised by Anderson), ed. 6. Pp. 559. Price $10.00. C. V. Mosby Co., St. Louis, Mo., 1942.

Practical Orthodontics is a splendid textbook that should be a "must" on the list of every undergraduate, postgraduate, and practitioner of orthodontics. There is a rearrangement of chapters which is an improvement. Many

chapters contain a bibliography for the earnest student. This edition is so completely and clearly illustrated that it might be described as "orthodontics at a glance." Anderson has included practically every system of orthodontics, from myofunctional therapy, through the many types of multibanded appliances to surgical correction. Many illustrations have been taken from the most recent papers bringing the book up to the minute. The reading of Dewey-Anderson is recommended for all dentists but particularly for any orthodontist who has a tendency to drop his professional literature.

G. S. Callaway.

Cleft Palate: By George M. Dorrance and John W. Bransfield: *Ann. Surg.* **117**: 27, 1943.

In 1925 Dorrance proposed the "push-back" operation for cleft palate. The purpose of the operation was to obtain complete velo-pharyngeal closure essential for the assurance of normal voice control. The original "push-back" operation sometimes left a hole in the anterior palate (in cases of complete cleft, and in unilateral lip-jaw splits) which necessitated the use of a plate for correction.

Various modifications tending to improve the results obtained by the "push-back" operation have been introduced from time to time by the authors as well as others. In addition various procedures previously introduced by others have been adopted and modified by Dorrance and Bransfield to meet the problems occurring in the "push-back" operation. Among these modifications is the use of the mucoperiosteum of the vomer (originated by Lannelongue, 1872). Pickler later advised the double vomerine flap in double, complete cleft palate. Second addition to the original "push-back" operation is the lining of the palatal mucoperiosteum flap with a Thiersch or split-skin graft. A splint devised by Dr. P. Gross is used to hold this flap in place. Every step and modification of the "push-back" operation is beautifully and adequately illustrated by color plates. The technique and indications for the operative procedures advocated by the authors for the various types of cleft palate are discussed clearly and in great detail. Several color plates illustrating the anatomy and physiodynamics of the palate and pharynx are presented.

Harry A. Salzmann, M.D.

Carcinoma of the Gum: By Lt. Comdr. George S. Johnson, U.S.N.R., and Rollin A. Daniel: *Ann. Surg.* **117**: 74, 1943.

Cancer of the gum is the term used by Martin, as well as by the present authors, to designate squamous-cell carcinoma arising in the buccal mucosa which covers the alveolar margin. The primary lesion of this condition differs from similar neoplasms which arise from other areas in the mouth and pharynx. Because of its proximity to bone, invasion of the latter is extremely early and may become quite extensive while the local ulceration remains minimal. Pain is an early symptom because of the early bone invasion and subsequent infection.

It is the authors' purpose to establish this lesion as an entity apart from other neoplastic oral lesions and to discuss the treatment of cancer of the lower alveolus based upon knowledge of its usual mode of spread.

The results of previously employed therapeutic measures—x-ray, radium and surgery—have generally been discouraging. Shaw, Ehrlich, etc., have called attention to the bone necrosis following irradiation and the low incidence of cures. Martin reported fifty-seven malignant growths of the lower gum treated by roentgen therapy with 26 per cent five-year cures; about 25 per cent of the patients treated by x-ray developed radio-osteomyelitis with some loss of bone.

The authors recommend cautery excision of the mandible, as described by Bloodgood and recently by Blair, Moore, and Byars, in all cases where it is felt the lesion may possibly be completely excised. In most instances the operation is supplemented by roentgenotherapy over the neck.

They report their observations of 111 cases of squamous-cell carcinoma of the buccal mucosa and the lower lip treated at Vanderbilt University Hospital since 1933.

Thirty (51 per cent) of these growths apparently originated in the gum, two arose in the gum of the upper alveolus, and 28 (47.5 per cent) began as an ulcer on the lower alveolar margin.

The results of these observations are presented in tabular form. Pre- and postoperative management as well as the technique of the operation are discussed. The presentation is enhanced by several x-ray plates and photographs depicting the pathology and clinical appearance of these patients before and after treatment.

The authors feel that eradication of the disease can be accomplished in a relatively large number of patients by wide, en bloc excision of the body of the mandible and its adjacent soft tissues. The surgical measures are supplemented by roentgenotherapy where indicated.

Harry A. Salzmann, M.D.

Finger-Sucking: Serial Dental Study From Birth to Five Years: J. H. Sillman, *New York State Journal of Medicine* **42**: 2024, 1942.

For the past eight years the author has conducted a dental study on over 1,000 newborn infants and has made over 200 models of their gum pads. This was followed by a serial study of 50 children from birth to 5 years, which includes 2 to 20 sets of consecutive casts for each child.

Irregularities of the teeth are common in the first dentition, regardless of habit. For example, rotations are found in 60 per cent of the incisors; the molars also are subject to similar rotations, but less frequently. These rotations are present even before the eruption of teeth, as seen in the roentgenogram, and remain so after eruption, with slight modifications. This is very important for us to bear in mind before we accuse finger-sucking of causing crooked teeth.

Before and during eruption of the deciduous teeth, particularly the first incisors and first molars, the child has the urge to bite on the overlying gum. Because the gums are not in contact the necessary stimulation is made possible

only with the aid of inserted fingers or foreign objects, and by the protrusive and lateral movements of the mandible. This urge to bite is a physiologic process and usually passes uneventfully before age 3 years. During this time, interference by heckling adults is apt to make suckers of nonsuckers, or to accentuate the force of sucking and create a habit. Under such conditions displacement of the teeth will occur.

Most discussions concerning the effect of sucking have not been based on objective findings. In order for the evidence to be complete, it is essential to have casts of the jaws before, during, as well as after the cessation of sucking.

A force of a certain intensity and duration will change the position of the teeth and the surrounding structures. It makes no difference whether the force is applied by an orthodontic appliance or a finger, but we do have to be sure that such a force is operating. In any event, the only area involved is the site of application, i.e., the anterior region. The molar relationship is not affected. I have had many examples of babies who were ardent suckers and biters of their fingers, yet the molar relationship was not disturbed. The force that maintains the mandible in its proper position is far greater than the force of the sucking.

Although Haas attributed space between the gum pads in the infant to sucking, it is my opinion that this space has nothing whatsoever to do with sucking, as similar openings are found in 50 per cent of our babies at birth. In the case of a thumb-sucker, the opening was present at the age of 13 months, and at 2 years the incisors showed no displacement, despite the fact that the sucking had become more vigorous. After this time, the parents would scold or slap the child's hand whenever he was caught sucking. Of course, the child sucked all the harder. At 3 years the maxillary incisors were in an unusual position. The casts revealed rotation of the lateral incisors. However, this was not caused by the sucking, since his brother and sister who never sucked their fingers, both have similar rotations. Assuming that the sucking has been a contributing factor to the unusual position of the teeth, it must not get all the blame, because this child would have had a malrelationship of the teeth regardless of the habit.

Another child sucked his thumb so vigorously from 8 months to 3 years and 2 months that it caused a callous formation on the digit. However, little effect on the position of the teeth was shown during this period. With the arrival of a baby sister, the sucking was intensified and his casts made at 4 years and 2 months show a marked increase in the protrusion of the maxillary teeth. Believing that he was psychologically ready to be helped, I explained to him that sucking was causing his teeth to stick out. His response was, "I don't want to have crooked teeth. I won't suck my thumb any more." He was old enough to help himself and has never sucked his thumb since. His casts made at 5 years show spontaneous correction of the protrusion.

Most children have the urge to bite before and during eruption of the first teeth. Heckling adults are often responsible for turning the physiologic sucking and biting into a habit. If by the age of 4 years sucking still persists, then the child should be helped to stop it.

Psychology of the Child. Mental and Physical Growth: By Joseph William Nagge, Ph.D., Associate Professor of Psychology, Kansas State Teachers College of Emporia. Pp. 530. Price $3.25. New York, The Ronald Press Co., 1942.

The attempt is made in this book to present a survey of the present status of child study. Those not essentially engaged in the field of child psychology will find the chapter on "Historical Introduction" of value since it will orient them to the evaluation of this fast-expanding field. Orthodontists will find the chapter on the physical growth of the child of immediate practical value.

Regarding the act of sucking, the author points out that, although this is one of the first coordinated human acts and one that has been observed to be present even before birth, there has been a surprisingly small amount of experimental study on this subject. The relationship of physiologic, anatomic, and mental ages is discussed as are the various aspects of physical growth. The book contains an excellent bibliography on development and psychology of the child.

From Infancy Through Childhood: By Louis W. Sauer, M.D., Ph.D., Assistant Professor of Pediatrics, Northwestern University Medical School, Chicago; Physician, Evanston Hospital, Evanston; Immunologist, St. Vincent's Infant and Maternity Hospital, Chicago, Ill. Medical Director, "The Cradle," Evanston, Ill. Illustrated. Pp. 200. Price $2.00. New York, Harper & Brothers, 1942.

This is a practical volume for the modern mother. It includes advice on health, feeding, and training of infants and children. With the present shortage of physicians, the mother will find here specific instructions for handling many situations in the healthful raising of children. An interesting and instructive series of photographs is included showing how the baby is to be handled. The information included on the care of the baby's teeth is meager, to say the least. An appendix is included on first aid for children.

News and Notes

American Association of Orthodontists Meeting Cancelled

The meeting of the American Association of Orthodontists, which was to have been held in May, 1943, has been cancelled.

MAX E. ERNST, Secretary
American Association of Orthodontists

Prize Essay Contest Postponed

The Research Committee of the American Association of Orthodontists announces the postponement of the Prize Essay Contest until the next meeting is called by the Association.

In order that those contestants who have already submitted manuscripts may not be discriminated against through this action, and also to make their studies available to the rest of the profession, their manuscripts are being returned to them with full authority for publication, wherever they may place them. A list of such manuscripts is being held in the office of the chairman, and the manuscripts or reprints thereof will be called for at the time of the judging.

The deadline for submission of manuscripts has been postponed indefinitely and new manuscripts may be submitted for consideration at any time until further notice. All manuscripts will be judged at the same time.

American Board of Orthodontics

The American Board of Orthodontics announces the cancellation of its 1943 meeting previously scheduled to be held in conjunction with the meeting of the American Association of Orthodontists in May. Due notice will be given of the next meeting of the Board.

B. G. DEVRIES, Secretary.

Cleveland Dental Society

The annual spring clinic meeting of the Cleveland Dental Society will be held on May 10, 11, and 12, 1943, at the Statler Hotel, Cleveland, Ohio.

Southern Society Meeting Cancelled

The 1943 meeting of the Southern Society of Orthodontists which was to have been held in Richmond, Va., has been cancelled on account of conditions brought on by the war.

E. C. LUNSFORD, Secretary.

New York Society of Orthodontists

The New York Society of Orthodontists held its Annual Meeting, March 8 and 9, 1943, at the Waldorf-Astoria Hotel, New York City.

The following program was contributed:

"The Development of the Head," Charles B. Davenport, Ph.D., Formerly Director of Carnegie Institute, Cold Spring Harbor, N. Y. "The Phase of Development Concerned With the Erupting and Shedding of Teeth," Milo Hellman, D.D.S., Sc.D., New York, N. Y. "Some Observations on the Development of the Skeleton in Children," W. W. Greulich, Ph.D., Professor Physical Anthropology and Anatomy, Director of Brush Foundation, Western Reserve University, Cleveland, Ohio. "Alteration of Occlusal Relations Induced by Experimental Procedure," Carl Breitner, M.D., D.D.S., New York, N. Y.

Symposium of the Philosophy Behind the Appliances

Ashley E. Howes, D.D.S., New Rochelle, N. Y., "Johnson." Robert H. W. Strang, D.D.S., Bridgeport, Conn., "Tweed." Ralph Waldron, D.D.S., Newark, N. J., "Atkinson."

"Revenue Act of 1942 With Special Relations to Tax Problems of Professional Persons," John P. Courts, Esq., Prentice Hall, Inc., New York, N. Y.

Clinics Supplementing Papers:

1. Ashley E. Howes
2. Robert H. W. Strang
3. Ralph Waldron

Fourth Mexican Medico-Dental Convention

The program of the Cuarta Convención Medico-Dental organized through the Asociación Mexicana de Ortodoncia was held in Mexico, D. F., March 1 to 6, 1943.

In addition to the many contributors to the program from the Republic of Mexico and from Latin American countries, there were numerous contributions upon the subjects of orthodontics and oral surgery.

Some of those who attended from North of the Rio Grande were:

Dr. Spencer R. Atkinson, D.D.S., Pasadena, Calif., Presidente Honorario de la Asociación Mexicana de Ortodoncia.

Daniel F. Lynch, D.D.S., Washington, D. C., "Accidentes de la cara y maxilares." (Historias clinicas de las batallas recientes.) (Accidents of the Face and Jaws.)

Brig. Gen. Leigh C. Fairbank, D.D.S., Washington, D. C., U. S. Army retired, "Tratamiento de las fracturas de los maxilares en el Ejército Norteamericano." (Treatment of Fractures of the Jaws in the North American Army.)

Francis J. Conley, D.D.S., Presidente de la Asociación Dental de California del Sur, "Que hace la Odontología Norteamericana y que planes tiene para el futuro." (What North American Odontology Is Doing and What Plans It Has for the Future.)

Charles Benbrook, D.D.S., Los Angeles, Calif., "Dentistería y organizaciones dentales." (Dentistry and Dental Organizations.)

Berto Olson, D.D.S., Los Angeles, Calif., "Exodoncia." (Exodontia.)

Ferris Smith, M.D., Grand Rapids, Mich., "Cirugía Plástica y reconstrucción maxilo-facial." (Plastic Surgery and Maxillofacial Reconstruction.)

P. C. Lowery, M.D., Detroit, Mich., "Prótesis quirúrgica." (Surgical Prosthesis.)

Harry Wright, D.D.S., Philadelphia, Pa., "Ortodoncia." (Orthodontics.)

Don Jose Aubertine, D.D.S., San Francisco, Calif., "Operative Dentistry."

Dr. J. Ben Robinson, D.D.S., Baltimore, Md., Director de la Escuela Dental de Baltimore, Md., y Presidente de la American Dental Association.

Pierre Viole, M.D., Los Angeles, Calif. (motion picture), "The Surgical Technique of Intratemporal Repair of the Facial Nerve."

George Shapp, M.D., Pasadena, Calif., "Cáncer de los labios y de la cavidad bucal." (Cancer of the Lips and Buccal Cavity.)

Arthur Smith, M.D., D.D.S., Los Angeles, Calif., "Cirugía reconstructiva, plástica y oral." (Reconstructive Surgery, Plastic and Oral.)

Berto Olson, D.D.S., Los Angeles, Calif., "Técnica quirúrgica con referencia al Pentotal sódico." (Surgical Technique With Reference to Pentothal Sodium.)

Pacific Coast Society of Orthodontists

The newly elected officers of the Pacific Coast Society of Orthodontists are the following:

President, Dr. J. Camp Dean, Oakland, Calif.
President-Elect, Dr. Sid Hoskin, Portland, Ore.
Vice-President, Dr. George Chuck, Long Beach, Calif.
Secretary-Treasurer, Dr. Earl F. Lussier, San Francisco, Calif.

Central Section of the American Association of Orthodontists

The Central Section of the American Association of Orthodontists held a business and luncheon meeting at the Palmer House in Chicago, February 23. The following men were elected to membership in this Society and in the American Association of Orthodontists:

Ralph Berkson, Robeson Bldg., Champaign, Ill.
Thomas A. Gardner, 1130 Medical Arts Bldg., Omaha, Neb.
Jay N. Pike, 811 Medical Arts Bldg., Minneapolis, Minn.
David J. Thompson, 101 N. York St., Elmhurst, Ill.

Members of the Society now in Service are:

Capt. Earl C. Bean
Station Hospital, Fort Sill, Okla.
(1717 Elm St., Lawton, Okla.)

Capt. Arlo M. Dunn
Station Hospital
Fort Riley, Kan.

George L. Englert
105th Med. Training Btn.
Camp Joseph T. Robinson, Ark.

Lt. J. S. Hoffer
601 Loraine Hotel
Madison, Wis.

Capt. Earl E. Shepard
21st Gen. Hospital, A.P.O. 600
c/o Postmaster, New York, N. Y.

Louis F. Tinthoff
U. S. Coast Guard
Alameda Tr. Sta., Alameda, Calif.

M. A. Ukena (Address not known)

Note of Interest

Dr. Noble A. Powell announces that his offices are now located at Route 2, Box 19A, Ventura, Calif.

The AMERICAN JOURNAL OF ORTHODONTICS AND ORAL SURGERY feels that its readers would be glad to be informed of the change of address and location of any orthodontists who have entered the Armed Services. If this information will be sent direct to the Editor, 8022 Forsythe Blvd., St. Louis, Mo., it will be published from time to time in the NEWS AND NOTES pages of the JOURNAL.

OFFICERS OF ORTHODONTIC SOCIETIES*

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Central Section of the American Association of Orthodontists

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Secretary-Treasurer, Oliver H. Devitt - - - - - - - 523 Republic Bldg., Denver, Colo.

Southern Society of Orthodontists

President, M. Bagley Walker - - - - - - - - - 618 Medical Arts Bldg., Norfolk, Va.
Secretary-Treasurer, E. C. Lunsford - - - - - - - 2742 Biscayne Blvd., Miami, Fla.

Southwestern Society of Orthodontists

President, Hamilton D. Harper - - - - - - - - Medical Arts Bldg., Shreveport, La.
Secretary-Treasurer, James O. Bailey - - - - - - Hamilton Bldg., Wichita Falls, Texas

American Board of Orthodontics

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James D. McCoy - - - - - - - - - - 3839 Wilshire Blvd., Los Angeles, Calif.
Joseph D. Eby - - - - - - - - - - - 121 E. 60th St., New York, N. Y.
Claude R. Wood - - - - - - - - - - Medical Arts Bldg., Knoxville, Tenn.

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Secretary-Treasurer, Edward I. Silver - - - - - - - 80 Boylston St., Boston, Mass.

Washington-Baltimore Society of Orthodontists

President, Kyrle W. Preis - - - - - - - - - - - 700 Cathedral St., Baltimore, Md.
Secretary-Treasurer, Meyer Eggnatz - - - - - - - Medical Arts Bldg., Baltimore, Md.

Foreign Societies†

British Society for the Study of Orthodontics

President, S. A. Riddett
Secretary, R. Cutler
Treasurer, Harold Chapman

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*The Journal will make changes or additions to the above list when notified by the secretary-treasurer of the various societies. In the event societies desire more complete publication of the names of officers, this will be done upon receipt of the names from the secretary-treasurer.

†The Journal will publish the names of the president and secretary-treasurer of foreign orthodontic societies if the information is sent direct to the editor, 8022 Forsythe, St. Louis, Mo., U. S. A.



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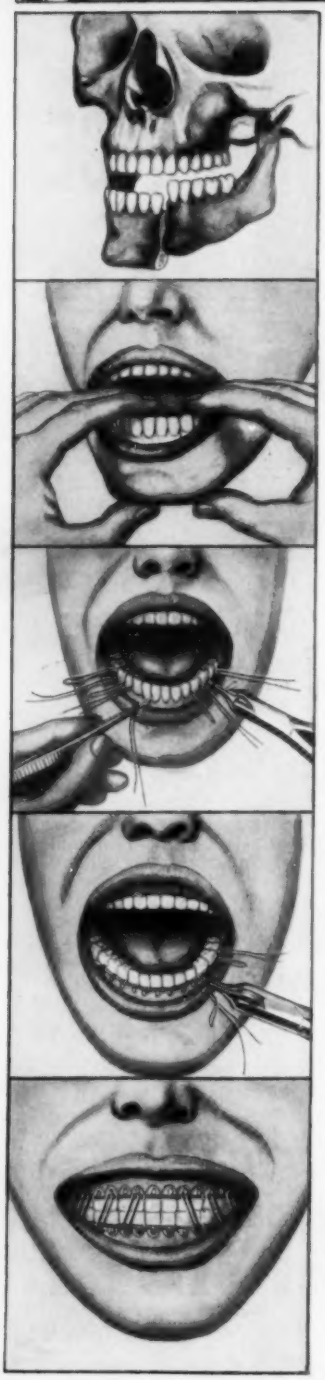
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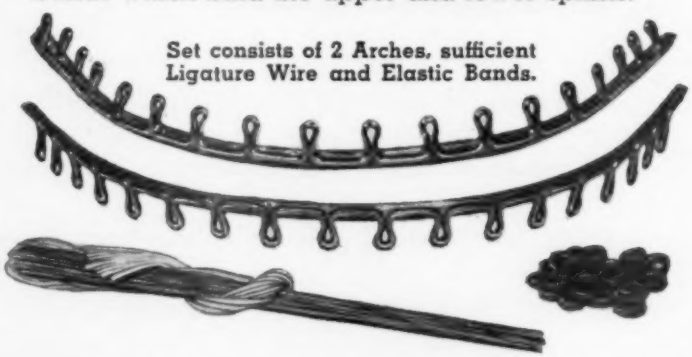
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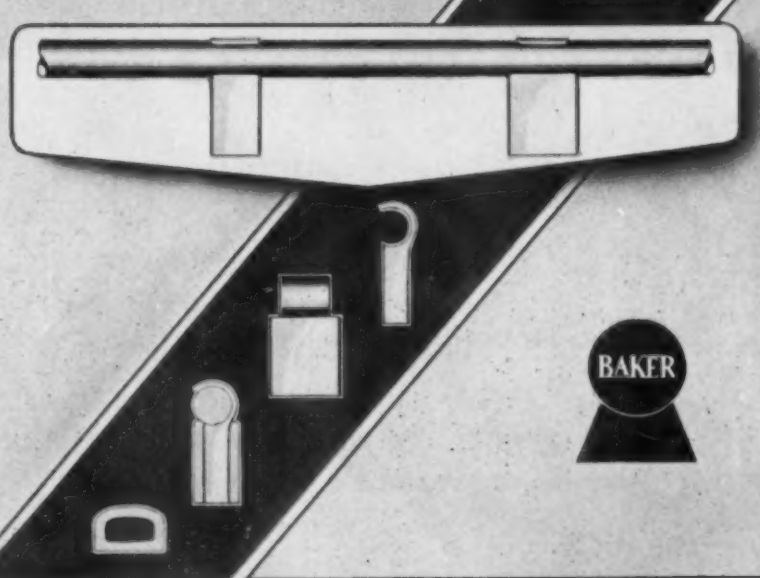
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POPULAR TOOTHPASTES AND POWDERS DID THIS: Here gingival recession is followed by deeply abraded cervical grooves and fillings. In clinical examination, over half of patients showed grooves from 0.1 m.m. to 1.5 m.m. As age advances, cervical exposure increases and abrasions multiply and deepen.

8 IN 10 ADULTS RISKED GROOVES

The clinical and laboratory findings* may be summarized as follows:

First, **58% of all adults examined had these grooves in softer calcified parts of teeth (exposed by receding gums)—cavities ground-in by abrasives contained in toothpastes and powders they regularly used.** *Second,* **the deepest ground-in cavities were found in teeth cleaned most thoroughly.** *Third,* **8 in 10 had sufficient gingival recession to run this risk constantly.**

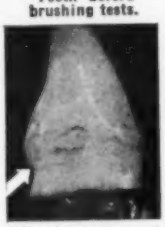
TEEL, the modern liquid dentifrice, overcomes this injury to teeth—because TEEL is the *only* leading dentifrice that cleans *without abrasives.* (See chart

*Journal of Dental Research, 20 565-95, Dec. '41.

below.) Moreover, TEEL is equal to other popular dentifrices in cleaning efficiency. Used daily in conjunction with the toothbrush, TEEL readily removes "materia alba," mucin plaques, and the usual surface discoloration.



Tooth before brushing tests.



After tests. Grooved left side was brushed with toothpaste—unharmed right side with liquid TEEL.

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TESTS SHOW DAMAGE CAUSED BY TOOTHPASTES AND POWDERS

Under identical conditions, the same teeth were brushed with TEEL or plain water and—on the reverse surface—with toothpastes or powders. Each test was approximately equal to six years' brushing *in vivo*.

	Depth of Abrasion (in hundredths of m.m.)
Toothpaste A	46.3
" B	40.6
" C	55.0
" D	33.4
" E	18.5
" F	32.5
" G	44.3

	Depth of Abrasion (in hundredths of m.m.)
Toothpowder A	79.0
" B	62.6
" C	82.3
BRUSH AND WATER	0.5
BRUSH AND TEEL	0.0

Above tests reported in Jrnl. of Dental Research, 20 583-95, Dec. '41; 21 335, June '42.

TEEL'S New Technique consists of—

1. *Twice daily* — Brush the teeth with TEEL; a few drops on dry or moist brush. Provides daily hygiene with no abrasion.

2. *Weekly* — Brush teeth for at least one extra minute with plain baking soda on brush moistened with TEEL. Necessary abrasive action each week to remove surface 'stain'.



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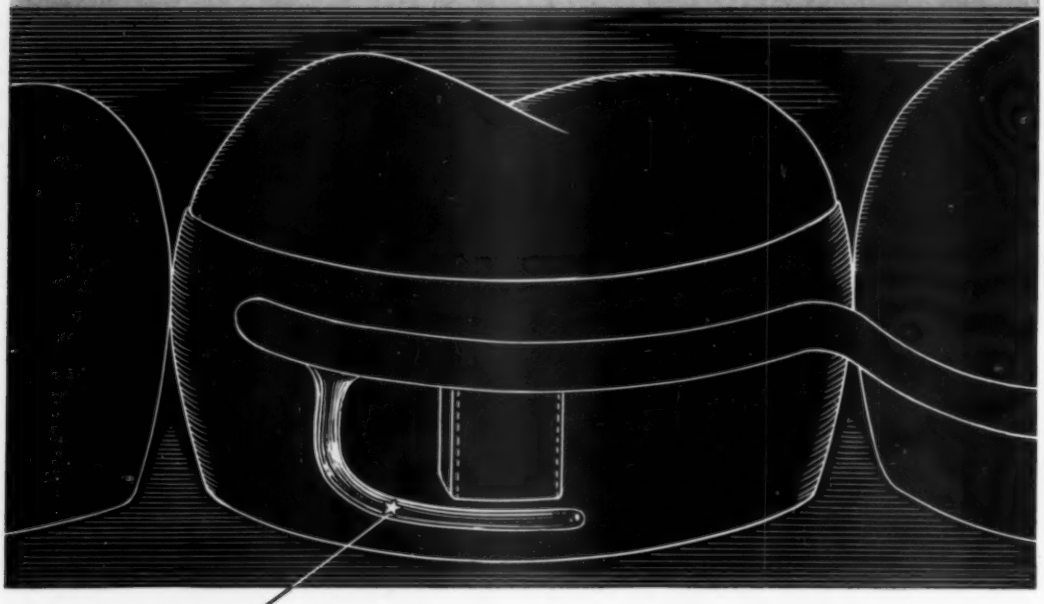
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Orthodontic Materials

MAY, 1943

Orthodontics

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Office of the Editor: 8022 Forsythe Boulevard, St. Louis
Published by The C. V. Mosby Company, St. Louis

American
Journal of Orthodontics
and Oral Surgery

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VOL. 29 MAY, 1943 No. 5

Original Articles

PRESIDENT'S ADDRESS

PACIFIC COAST SOCIETY OF ORTHODONTISTS

BEN L. REESE, D.D.S., LOS ANGELES, CALIF.

WHEN I assumed the duties of President of the Pacific Coast Society of Orthodontists in the spring of 1941, I looked into the future, as did we all, with a nation at peace. We had weathered successfully the preceding years commonly known as the "depression period." In spite of these vicissitudes, our Society had moved steadily ahead in standards, membership, and financial status. There was a war going on in Europe, but Europe was a long way off. True, we were sympathetic with the Allied Nations' cause, but we gave little thought to the possibility and necessity of our country entering the conflict.

I thought we could look forward to the ensuing two-year term of office with "business as usual." This illusion continued until well into the spring and summer of 1942, but as time went on doubts began to arise in my mind as to the advisability of holding a general session, as planned, for February, 1943. This question soon took on an entirely different aspect. Rather than being advisable, I began to wonder if it would be even possible to continue with our plans. I watched the Nation preparing for an all-out war, saw the crowded conditions develop on the nation's vital transportation systems, heard the continued threats of gas rationing to save rubber, and the pleas from our leaders in Washington for the civilians to remain at home.

I realized more and more that we had no right to hold our convention. This conviction was general throughout the Society, for on putting the question to a vote of the Sections, we found the Northern and Southern Sections were unanimously in favor of abandoning all plans for a convention for the duration of the national emergency. Our Central Section, true to its spirit of hospitality which it has always so graciously shown, was willing to entertain us again even in these days of food shortages and overflowing hotels. However, the Board

of Directors of the Society voted to cancel the meeting and all plans for the general session and scientific program were dropped.

Our Society has made steady progress during the last two years. Our membership has grown to a total of 129 active members. Of this number, twelve were newly affiliated during this term. The following is a list of the men who have joined with us since February of 1941:

Dr. Bernard Matzen
Dr. Noble A. Powell
Dr. Lyle Dale Russell
Dr. Arthur F. Skaife, Jr.
Dr. Robert Smith
Dr. Jack M. Loughridge
Dr. Ray V. Chase
Dr. David L. England
Dr. Robert James Gawley
Dr. Verne V. Smith
Dr. Donald J. Harrison
Dr. Harry Cimring

Most of these have been associated with us as guest members for the three-year period immediately preceding their application for membership in our Society. It is an honor to add the names of men like these to our roster. I extend to you, our new members, a cordial welcome. You have all signed the code of ethics of the Society. By striving conscientiously to live up to this code, you will be helping us in the promotion of good fellowship and professional unity. It is the duty of each member to carry on in the high principles of our organization. Not only is this true, but also we look to you to carry on with us to higher and higher standards in our profession.

We should all be proud to hear that we now have ten members who have enlisted in our military service. These men are:

Lt. Guy Hughes, Mare Island, Calif.
Lt. Jack Taylor, U. S. Navy
Major Scroggs Singleton, Air Corps Induction Center, Santa Ana, Calif.
1st Lt. Seymore L. Winslow, Gieger Field, Base Infirmary, Spokane, Wash.
1st Lt. Harry Cimring, Dental Corps, Station Hospital, Hamilton Field, Calif.
1st Lt. Willard D. Crapo, Hammer Field, Fresno, Calif.
1st Lt. Herbert V. Muehnic, Station Hospital, Hammer Field, Fresno, Calif.
1st Lt. Lawrence Furstman, U. S. Army Dental Corps
1st Lt. Robert L. Whitney, U. S. Army Dental Corps
1st Lt. Frederick L. Epley, Station Hospital, Sawtelle, Calif.

Without exception this action has been taken at great personal sacrifice. Only loyalty to country and the inner urge of patriotism could have caused our members to discontinue a lucrative private practice to enter into the Armed Forces of the United States. While in the military service these orthodontists will of necessity be doing general dentistry. This is definitely contrary to certain clauses in our Constitution and By-Laws. However, a recent resolution passed by the Board of Directors has set aside this portion of the Constitution for the duration of the war for our members in military service. Action was also taken in the same resolution to refund the dues to each member who has entered the service for the period of the war. Another of those who has been called upon to make sacrifices in the present emergency is our fellow member, George Nagamoto, who is at present in the War Relocation Authority Dental Clinic, Amache, Colorado, and who, I am sure, in his present surroundings is doing his utmost to promote the best interests of our profession, as well as our country.

During the administration of my immediate predecessor, a great amount of work was accomplished toward a new Constitution and By-Laws for the Society. In fact, a complete draft was in the hands of the Board of Directors at the February, 1941, meeting. After a few minor changes, the present version was submitted to the membership for a vote of ratification. As a result of this action we now have a new Constitution and By-Laws. This embodies the original in substance being changed only to harmonize more fully with that of the American Association of Orthodontists, of which we are a constituent body. I hope all of the members have read it. One change to which I wish to call your attention is the manner of electing new members. Under the new ruling, a prospective member must be approved by the Section in which he resides before his name can be acted upon by the Board of Directors of the Society. The wisdom of the committee in making this change should be obvious to all.

During the last two years, two of our active members have been called from our midst by death. Shortly after our last meeting we learned of the passing of Charley Mann. His death came as a shock to many of us since he had just been with us in San Francisco a short time before, in good spirits and apparent good health. Later came the news of the death of Dr. J. H. Winstanley, who died at his home in Wenatchee, Wash. These men will be greatly missed by our Society. Their loyalty and good fellowship were in evidence on all occasions.

It has also been the misfortune of our Society to lose one of our honorary members. Our general session meetings will not seem complete without having John Marshall present and on our program. We have indeed lost a friend and a fellow worker. In the field of research we could always depend on John to carry out any investigation with complete thoroughness.

It has been the custom in the past for the President to recommend whatever changes he may have in mind which he believes to be of benefit to the Society. It seems to me that quite frequently these recommendations are made, reported on by the committee appointed for the purpose, and then promptly forgotten by the officers in charge.

I am in hopes that a like fate will not befall an idea which I here submit. We have in the Pacific Coast Society of Orthodontists three distinct organizations known as Sections. Being geographically somewhat removed from each other, we, as a necessity, function independently. With the exception of brief notices in The *Bulletin* every three months, very little is known as to what the other Sections are doing or thinking. In the past it has been the policy of the main Society to hold biennial sessions with no definite arrangements toward any cooperation of the Sections between these meetings. This leaves us more or less isolated from each other during these two-year periods.

I feel that a definite plan should be formed, so that whatever of real scientific value appears in one Section may be later put on the program of the other two. This should act as an incentive with the members to be on the alert for worthwhile material, and it would thus improve the quality of our Sectional programs. I can see no reason why we cannot, in this manner, develop programs of sufficient value and interest in each Section to occupy a full day and evening several times a year.

This should also act as a build-up for our regular general session. Since the benefit from such a plan would result to the whole membership, it would seem only fair for the expense to be borne by the main Society. In the absence of a general meeting this year, we could in this way utilize whatever we have of outstanding value to the Sections, and at the same time be working in closer cooperation toward our next meeting in San Francisco. The true cause for the existence of any professional society is the dissemination of scientific facts which will improve the ability and service of its members to society. Some such plan as this can well be followed for such a purpose. The responsibility of selecting material for this purpose should be delegated to one person, and I would suggest the director or censor of each Section for this duty.

In the past, the highlight of each term of office for the President has been the general assembly held in San Francisco. In it he has seen the culmination of his past two years of office. Under existing conditions it did not seem wise to hold our meeting this year. Furthermore, we have no way of determining just when it will again be advisable. It depends entirely on the length of the war, unfortunate for me that I have been prevented by these causes from having had the pleasure of helping to prepare a program and officiating at a meeting at the close of my term of office. However, I have greatly enjoyed serving our Society for the past two years.

It has been a great pleasure to represent the Society at the annual meetings of the American Association of Orthodontists in New York and New Orleans. These two events are definite highlights in my administration. I shall long remember the friendly cooperation given me by all the officers and committeemen during these last two years. It has been a pleasure to work with these men. They have aided me greatly in whatever of benefit I have been able to give to the Society. To them I offer my sincere appreciation for their assistance.

The time has now come for me to relinquish my office to my successor, Dr. J. Camp Dean, our president-elect. I feel the Society is especially fortunate in having a man of such sterling qualities, and who stands so high in our profession to represent us for this next term of office.

We know that conditions will be critical for all of us for the duration of this war. Also that our plan of life will have to be changed to meet it. However, with J. Camp Dean at the helm we can rest assured that the affairs of the Society are definitely in capable hands.

THE EARLIEST KNOWN FOSSIL STAGES IN THE EVOLUTION OF THE ORAL CAVITY AND JAWS

WILLIAM K. GREGORY, PH.D., D.SC., NEW YORK, N. Y.

FROM what remote sources did we inherit our oral cavity and by what steps were its present complexities attained?

The four principal fields which have yielded the evidence here summarized are systematic zoology, comparative anatomy, embryology, paleontology. Experience proves that no one of these fields may long be neglected if even a first approximation to the whole truth be hoped for. For example, if we neglect systematic zoology, we may fall into the error of attempting to homologize the structures of human anatomy with those of animals that are so far removed from man that such comparisons may be very misleading. No doubt it is safe to make close comparisons and homologies between the jaw of man (Fig. 1, *VIII*) and those of anthropoid apes (Fig. 1, *VII*) because the apes are, relatively speaking, closely related to man; but if we were to take it for granted that the human mandible is homologous with the lower jaw of a shark, we should be making a serious error; while if we supposed that the human mandible was at all homologous with that of any arthropod, such as a lobster or an insect, we should be equating things that have a similar function but have very probably arisen from totally different sources.

In brief, in attempting to homologize apparently corresponding parts in man and other animals we should never fail to begin our comparisons between animals that stand near together in the zoologic tree of life and then gradually and tentatively extend our comparisons to those that are farther and farther removed from man.

During the past four decades the materials amassed in The American Museum of Natural History and the investigations carried on by its staff and by colleagues of Columbia University and elsewhere have afforded me many opportunities to check the general morphology of the skeletal framework of the oral cavity from man downward, from the lower vertebrates toward man, as well as into very many side branches. For the present occasion, however, the limitations of time and printed space necessitate a great condensation in an attempt to outline the main story of the evolution of the mouth and related structures, beginning with the lowest animals and working toward man.

THE ORAL CAVITY IN INVERTEBRATES

Since the mouth, almost by definition, is the gateway to the primitive gut, we might suppose that the mouth and its parts are always the same wherever we find them. But the evidence of embryology proves that the mouth of the coelenterates (including hydroids and jellyfishes (Fig. 2) corresponds rather with the vent than with the mouth of vertebrates. Among the arthropods (including crustaceans, scorpions, insects) as well as in other segmented invertebrates the prostoma, or blastopore, or mouth of the gastrula, becomes

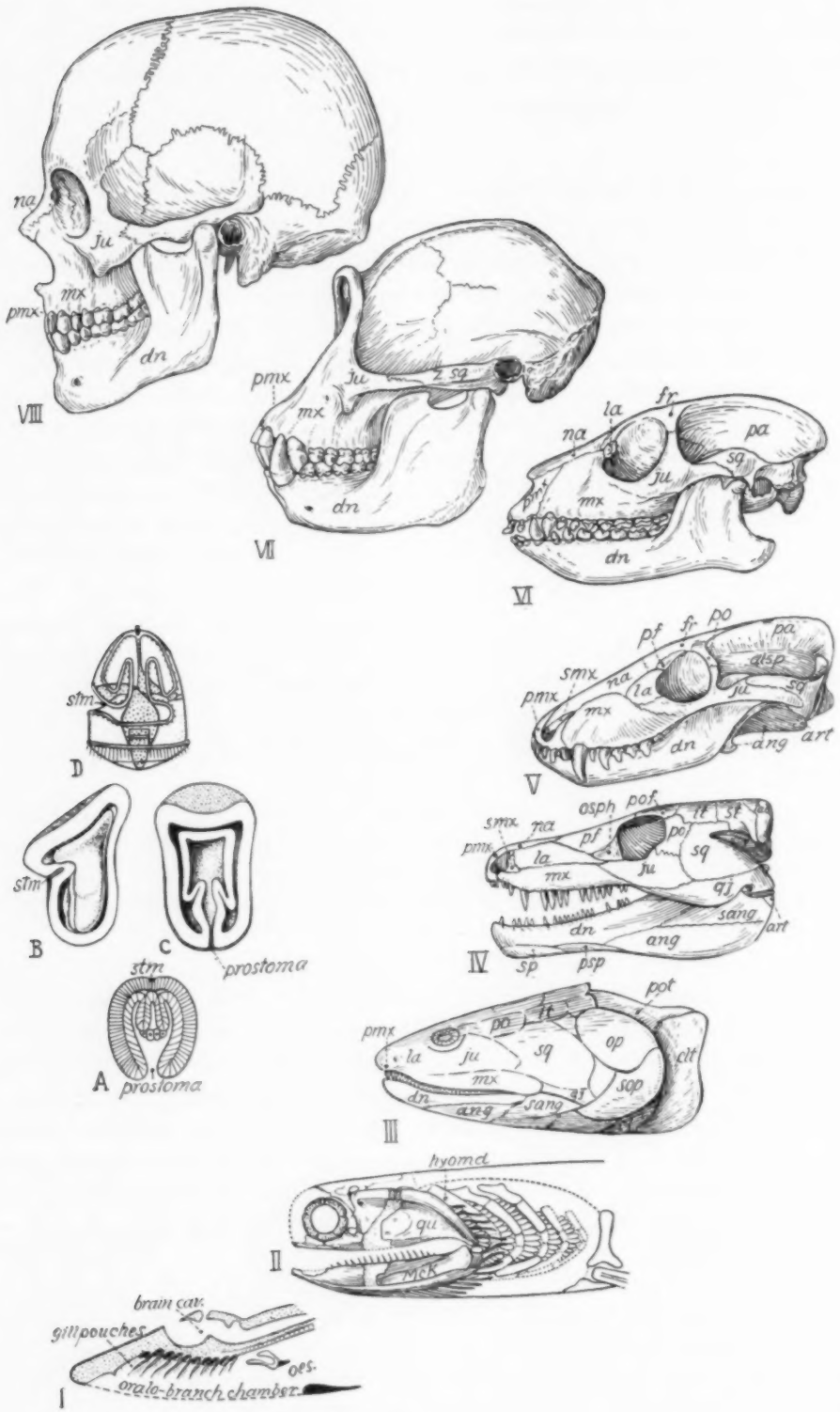


Fig. 1.

(For legend see opposite page.)

elongated and gives rise both to the proctodaeum or embryonic lining of the anus and to the so-called "stomodaeum" or embryonic lining of the mouth. In vertebrates we may note that the blastopore gives rise to the primitive streak as well as to the neural folds and protovertebrae but not to the stomodaeum. There is indeed good evidence that the true stomodaeum and mouth of vertebrates are not at all homologous with the similarly named structures in arthropods but that the vertebrate mouth pouch arises beneath the neural folds.

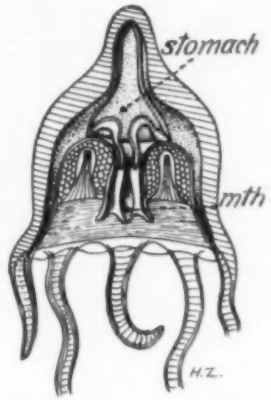


Fig. 2.—Section of jellyfish, showing correspondence of mouth to prostoma of starfish (Fig. 1, *C*.) (From Parker and Haswell, after Haeckel.) (From *A Text-Book of Zoology* by T. Jeffery Parker and William A. Haswell, Vol. I, 1897, Courtesy of Macmillan and Company. Reprinted in *Our Face From Fish to Man* by William K. Gregory, 1929, courtesy of G. P. Putnam's Sons.)

The mouth parts of arthropods (Fig. 3) are derived from the anterior thoracic appendages, which in turn arise on either side of the elongate blastopore or prostoma. The late Professor Patten strove to show that the vertebrates had been derived from the forerunners of the scorpion group (Fig. 4). He thought that the primitive mouth or prostoma became smaller and finally closed over, but agreed with other authorities that the vertebrate mouth cavity arose as a new pouch beneath the projecting brain fold. He regarded the

Fig. 1.—Main stages in the evolution of the jaws from early vertebrates to man. *A-D*. The prevertebrate forerunners. Appearance of the prostoma and stomodaeum in embryo stages. *A*, Gastrula stage of *Sagitta*, the "arrow worm," showing beginning of stomodaeum; the prostoma = the blastopore. (From Parker and Haswell after Lang.) *B*, Embryo starfish *(Asterina gibbosa)*; section showing inpushing of stomodaeum toward gut. *C*, Transverse section of same, showing prostoma (blastopore). (*B* and *C* from Parker and Haswell, after Ziegler.) *D*, *Tornaria* larva of "acorn worm" *(Balanoglossus)*. (From Parker and Haswell, after Spengel.) At this stage the stomodaeum opens directly into the gut.

I. Ostracoderm *(Cephalaspis)*. Sagittal section of head, showing relations of brain cavity and oralo-branchial chamber. The dark ovals represent the efferent vessels above the gills. (Based on data from Stensiö.) *II*. Acanthodian, showing an early stage in the evolution of the oralo-branchial arches, the primary jaws (palatoquadrate, Meckel's cartilage) still bearing gills. (After Watson.) *III*. Devonian lobe-finned fish *(Eusthenopteron)*, showing the bony mask or surface skeleton of the head. The primary jaws are covered by numerous surface bones, which are connected at the rear with the opercular series. (After Gregory and Raven.) *IV*. Primitive Permian reptile *(Seymouria)*, which has advanced beyond the fish stage in the loss of the opercular series and elongation of the preorbital face. (After T. E. White.) *V*. Advanced mammal-like reptile *(Thrinaxodon liorhinus)* from the Triassic of South Africa, showing increasing dominance of the dentary and reduction of postdentary elements. (From specimen, with additional data from Broom and Parrington.) *VI*. Primitive Eocene primate *(Notharctus osborni)*, showing completion of the temporomandibular joint characteristic of mammals and a quite primitive stage of the dentition. (From original specimens.) *VII*. Skull of chimpanzee, showing incipient shortening and downward deflection of the preorbital face. The dental formula is the same as in man but the canine teeth are enlarged. (From original specimen.) *VIII*. *Homo sapiens*, showing extreme shortening of the preorbital face and tooth row, and enlargement of the nose and chin, correlated with upright posture and overdevelopment of the braincase. (Based on Cunningham's *Anatomy*.) (Fig. 1 *A*, *B*, *C*. From *A Text-Book of Zoology* by T. Jeffery Parker and William A. Haswell, Vol. I, 1897; Fig. 1 *D*, Vol. II, ed. 6, 1940, courtesy of Macmillan and Company. *I*, From Skrifter om Svalbard og Nordishavet, Nr. 12, Part I, 1927, courtesy of Jacob Dybwad, Oslo. *II*, From Philos. Trans. Roy. Soc. London, 1937, Vol. 228, No. 549, courtesy of Cambridge University Press. *III*. From Annals New York Academy of Sciences, 1941, Vol. 42, courtesy of New York Academy of Sciences. *IV*. From Bulletin Museum of Comparative Zoölogy at Harvard College, 1939, Vol. 85, courtesy of Museum of Comparative Zoölogy. *VIII*. From *A Text-Book of Anatomy* by D. J. Cunningham, 1903, courtesy of William Wood and Company.)

vertebrate jaws and gill arches, however, as derivatives of the basal parts of the thoracic appendages of arthropods. For many years I have carefully studied the details of Patten's theory but can say here only that, in common with other students of the problem, I find his evidence defective at several critical points. I have elsewhere* reviewed the evidence for the following con-

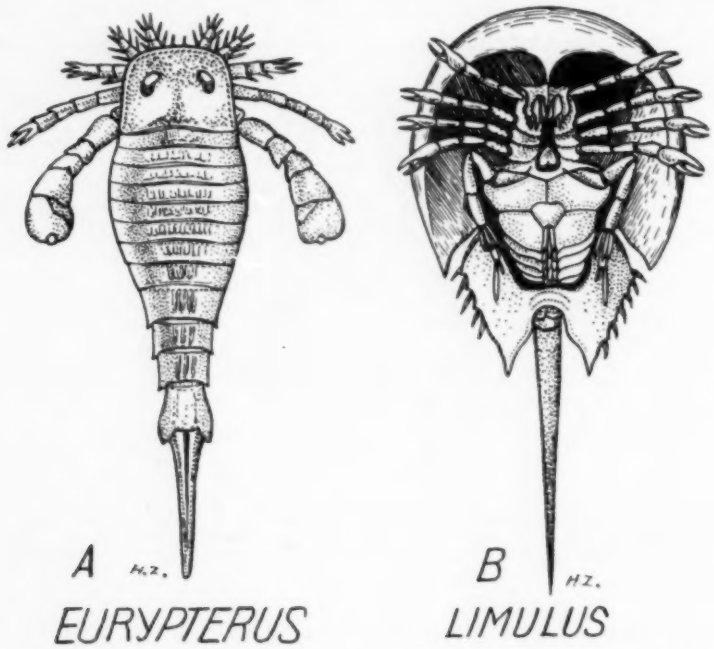


Fig. 3.—Primitive arthropods. *A*, Silurian eurypterid. (From Parker and Haswell, after Nicholson and Lyddeker.) *B*, Modern "king crab." Under side, showing arrangement of jointed appendages around mouth. (From Parker and Haswell, after Leuckart.) (From *A Text-Book of Zoology* by T. Jeffery Parker and William A. Haswell, Vol. I, 1897, courtesy of Macmillan and Company. Reprinted in Quarterly Review of Biology, Vol. 10, 1935, courtesy of Williams and Wilkins Company.)

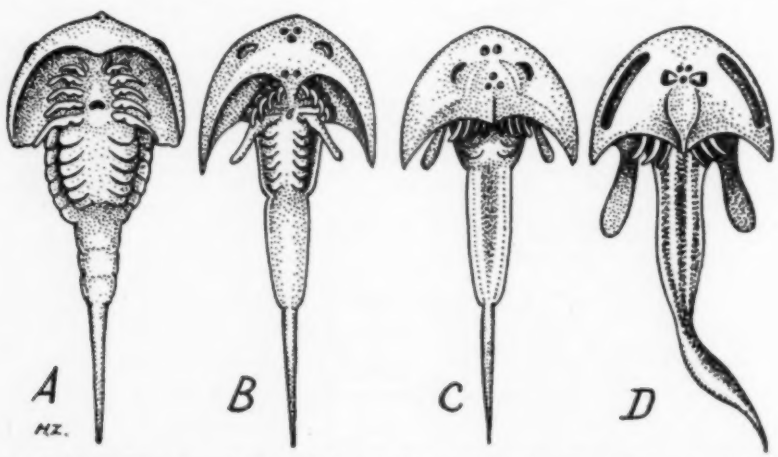


Fig. 4.—Patten's theory of the origin of the vertebrates from the remote forerunner of the "king crab." The essential feature of this theory is that the functionally ventral side of the primitive arthropod *(A)* was transformed into the dorsal side of the vertebrate *(D)* represented by a cephalaspid ostracoderm. (After Patten.) (From *The Evolution of the Vertebrates and Their Kin* by William Patten, 1912, courtesy of P. Blakiston's Son and Company. Reprinted in Quarterly Review of Biology, Vol. 10, 1935, courtesy of Williams and Wilkins Company.)

*"Reduplication in Evolution," Quart. Rev. Biol. **10**: 274-276, 1935; "The Transformation of Organic Designs: A Review of the Origin and Deployment of the Earlier Vertebrates," Biol. Reviews **11**: 318, 1936.

clusions: (1) that the vertebrates were not derived from the arthropods; (2) that the mouth of vertebrates is not homologous with that of arthropods; (3) that the jaws of vertebrates were not derived from any parts of the thoracic appendages of arthropods.

Most later authorities agree that among all the diversified hosts of the invertebrates the Echinodermata, including the starfishes, sea lilies, sea urchins and holothurians or sea cucumbers, have the best claim for derivation from some extremely ancient invertebrate stock which also gave rise to the vertebrates. The free-swimming larvae of echinoderms (Fig. 5) have retort-shaped digestive tracts surrounded by ciliated folds. These echinoderm larvae are rather similar to the free-swimming larvae of *Balanoglossus* (Fig. 5*A*), the so-called acorn worm, which is generally classed as the lowest of the existing chordates. In both groups the larval mouth tube leads to a sacklike stomach; this opens below in a short anal tube. The anal opening (prostoma) seems to correspond to the mouth of coelenterates.

The echinoderms, the balanoglossids, and *Amphioxus* also agree in the general mode of formation of their coelomic cavities and their mesoderm. In short it seems possible that in spite of the enormous differences in general construction between later echinoderms and chordates, the oral cavity of the latter may well be homologous with that of the earliest echinoderms.

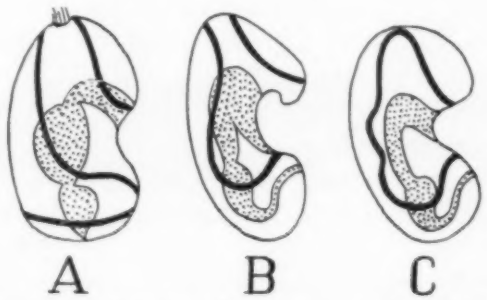


Fig. 5.—Free-swimming larvae of (*A*) Tornaria and (*B*) starfish (*Bipinnaria*), (*C*) sea cucumber (*Auricularia*). (After Delage and Hérouard.) (From *Traite de Zoologie Concrète*, Vol. 8: *Les Procordés* by Yves Delage and Edgard Hérouard, 1898, courtesy of Schleicher Frères. Reprinted in *Our Face From Fish to Man* by William K. Gregory, 1929, courtesy of G. P. Putnam's Sons.)

THE ORAL CAVITY IN AMPHIOXUS

In *Amphioxus* (Fig. 6), which is generally regarded as the most primitive of all living chordates, the body is dartlike, the notochord being prolonged into a long rostrum. The animal darts into the sand headfirst but then turns upward its elaborate buccal funnel, which is surrounded by sensory tentacles. The so-called "wheel organ," a band of large cilia on the inner side of the buccal funnel, draws in a current of food-bearing particles and oxygen. Behind the buccal funnel is a relatively huge hollow cylinder, the pharynx, perforated with more than a hundred pairs of gill slits. Ciliated bands draw in the water from the buccal funnel through a narrow opening surrounded by small tentacles which project backward into the pharynx. This small opening seems to correspond to the mouth of higher vertebrates. It is barely possible that this elaborate selective and respiratory apparatus corresponds with the tentacles and ciliated bands of echinoderms, but it may all be a new specialization peculiar to *Amphioxus*.

THE ORAL CAVITY IN AGNATHA

The most ancient and primitive of the fossil chordates were the extinct ostracoderms of the Silurian and Devonian periods. Here we find beneath a considerable diversity of external forms a true and reliable morphologic ground plan from which the special plans of all higher vertebrates have been derived.

The head and thorax of the more typical ostracoderms were protected by a shell-like armor—whence the name *ostracoderm*, meaning shell-skin. This armor was somewhat like dentine in structure but in the more primitive forms (e.g., *Pteraspis*, Fig. 7*A*) it lacked bone cells. The surface layers were deposited by papillae, which were essentially like the placoid tubercles of sharks; beneath this layer were large channels, presumably carrying blood or lymph; at the bottom was a stratified base.

The inner surface of this armor (Fig. 7) was molded around the brain tube, the optic cups, and the semicircular canals; it preserved the imprints of the roof

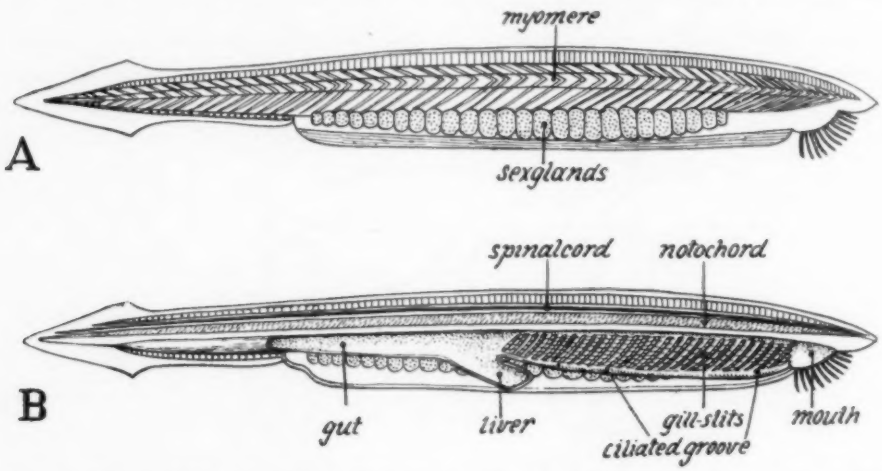


Fig. 6.—Anatomy of the lancelet, the most primitive living chordate animal. (Based on Delage and Hérouard.) *A*, Entire animal, seen as a semi-transparent object. *B*, Longitudinal section. (From *Traite de Zoologie Concrète*, Vol. 8: *Les Procordés* by Yves Delage and Edgard Hérouard, 1898, courtesy of Schleicher Frères. Reprinted in *Our Face From Fish to Man* by William K. Gregory, 1929, courtesy of G. P. Putnam's Sons.)

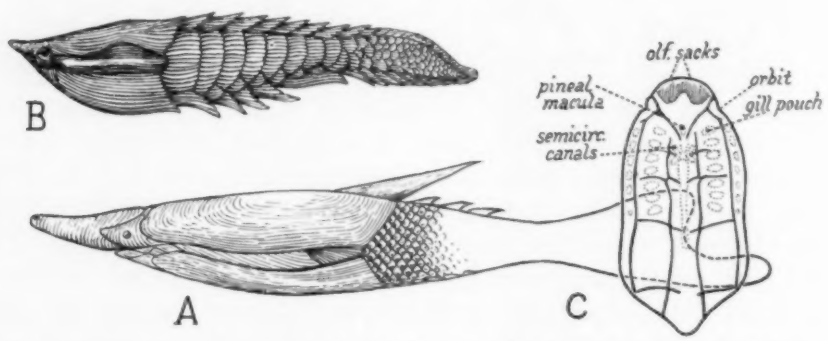


Fig. 7.—An early stage in the evolution of the vertebrate mouth parts illustrated in the pteraspid ostracoderms. *A*, *Pteraspis*, showing jaw plates around mouth. (Adapted from E. I. White and Powrie and Lankaster.) *B*, *Anglaspis*. After Kiaer. *C*, *Poraspis*. Mold of interior of shield, seen from above, showing imprints of the brain, gill pouches, etc. (After Kiaer.) (*A*, From *A Monograph on the Fishes of the Old Red Sandstone of Britain* by James Powrie and E. Ray Lankester, Part I: *The Cephalaspidae* by E. Ray Lankester, 1868, courtesy of the Palaeontographical Society, London; and from Philosophical Transactions of the Royal Society of London, (Series B), Vol. 225, 1935, courtesy of the Royal Society of London. Reprinted in *Our Face From Fish to Man* by William K. Gregory, 1929, courtesy of G. P. Putnam's Sons. *B*, *C*. From Skrifter om Svalbard og Ishavet, Nr. 52, 1932, courtesy of Jacob Dybwad. Reprinted in Biological Reviews, Vol. 11, 1936, courtesy of the Cambridge University Press.)

of the mouth, of the gill sacks, seven on each side, and of the small lateral gill pores; these gill pores opened from the gill sacks into a longitudinal collecting duct; this in turn ended near the posterior border of the shield in a single branchial opening. Thus the mouth cavity was closely associated with the pharyngeal or branchial chamber and the large space in the fossil specimens which includes both chambers is called by Stensiö the oralo-branchial chamber (Fig. 1, *I*).

On the floor of the mouth in *Pteraspis* there was a system of plates which seems to have permitted respiratory and feeding movements. This system was connected in front with plates that formed the lower margin of the mouth. The latter in turn varied from a narrow tubelike opening to a transversely widened slit. Kiaer has shown that in *Pteraspis Vogti* the median pair of mouth plates bore fine, toothlike dentinal processes which may have served as teeth and were appressed to the under side of a sort of palatal plate on the roof of the mouth. Presumably the roof and floor of the mouth cavity were covered with ectodermal epithelium brought in by the stomodaeal pocket.

Thus it seems that *Pteraspis* had begun to develop functional jaws which may even have served to seize small living prey. Nevertheless the ostracoderms are placed in a superclass named Agnatha, or jawless chordates, which includes also the cyclostomes (the living lampreys and hagfishes); this superclass stands in contrast with all the higher vertebrate classes, which are collectively designated as Gnathostomata, having mouths with jaws. This is because it is assumed that the jawlike plates of ostracoderms were not "true" jaws of the complex type seen in the gnathostomes. But what did they lack to entitle them to be called "true" jaws?

In the modern cyclostomes (Fig. 8), which are believed to be the, in some respects, greatly modified derivatives of the ostracoderms, we find elaborate structures which are more properly called rasps than jaws; these include rasplike paired dermal plates studded with thorny denticles and fixed upon a huge muscular "tongue" which can be moved back and forth. The wide circular buccal expansion or sucking-disc likewise bears a field of thorny denticles by means of which the lamprey attains a grip upon its prey and holds it against the action of the rasp. The cartilage-bar that lies at the core of the so-called "tongue" of cyclostomes was equated by Stockard (1906) with the Meckel's cartilages or lower jaw bars of the shark. If this were correct, the cyclostomes would not be truly Agnatha, at least in the descriptive sense. But even though some of the tongue muscles of cyclostomes are innervated by nerves which appear to correspond to the mandibular branch of the trigeminus of other vertebrates, this does not prove that the cartilage-bars which are moved by those muscles are homologous with the Meckel's cartilages; because these "tongue" bars lie in or near the midline and thus correspond in position rather with the anteroventral parts of the hyoid arch than with the Meckel's cartilages, which lie on the outer side in sharks and other primitive fishes.

This rasping apparatus in cyclostomes is thus a very specialized derivative of the conditions found in the pteraspid ostracoderms and is radically different from the true jaws of fishes.

However, in the larval stage of the lamprey (Fig. 8*B*), before this rasping apparatus is developed, the general relations of the oralo-branchial chamber are

essentially as in the ostracoderms. In both cases the oralo-branchial chamber includes the stomodaeal pouch, plus the pharynx or branchial chamber.

Thanks to the researches of Stensiö it is known that in the cephalaspid ostracoderms (Fig. 1, *I;* Fig. 9*B*) there was an endoskeletal tissue which filled the spaces in the folds between the gill pouches and surrounded the brain and primary sense organs. In the larval lamprey the interbranchial skeleton appears as the "branchial basket." This consists of a cylindrical shell perforated with numerous circular and irregular apertures. No parts of this are articulated one with the other but there is evidently considerable springiness or flexibility of the basket as a whole. Even in the adult lamprey the branchial basket is still not broken up into segments and the only movable articulation is found between the "tongue" bar and a small cartilage which is attached to the distal end.

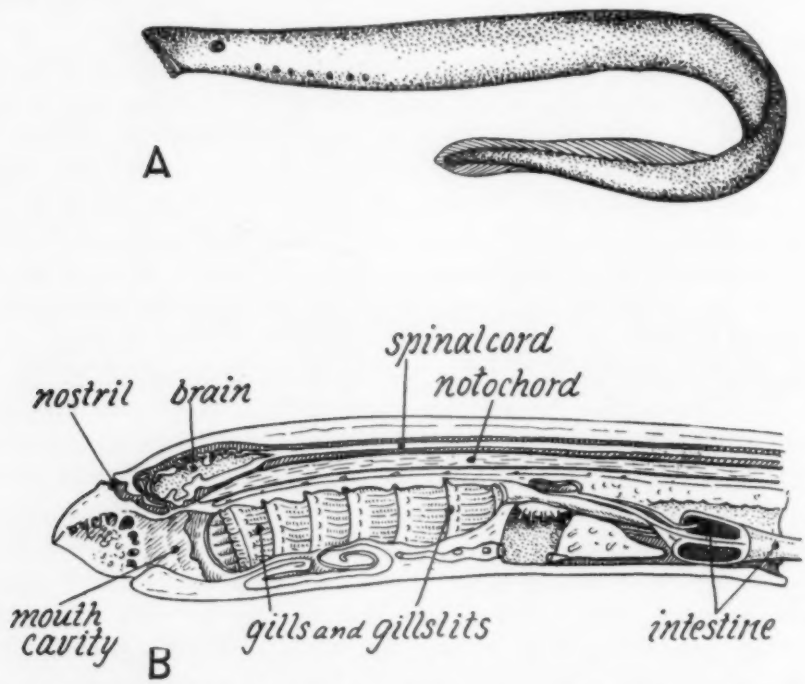


Fig. 8.—The modern lamprey *(A)*, a modified derivative of the ostracoderm stock, showing disclike mouth armed with thorny denticles. (After Jordan and Evermann.) *B,* Longitudinal section of larval lamprey, enlarged. (After Goodrich.) (*A.* From *The Fishes of North And Middle America,* by David Starr Jordan and Barton W. Evermann, 1896, courtesy of the United States National Museum. *A, B.* Reprinted in *Our Face From Fish to Man* by William K. Gregory, 1929, courtesy of G. P. Putnam's Sons. *B.* From *A Treatise on Zoology.* Ed. Sir Ray Lankester. Part IX: *Vertebrata Craniata* (First Fascicle: *Cyclostomes and Fishes*) by E. S. Goodrich, 1909, courtesy of Adam and Charles Black, London. Reprinted in the INT. J. ORTHODONTIA, ORAL SURGERY, AND RADIOGRAPHY 17: 1138, 1931, courtesy of The C. V. Mosby Company.)

Thus neither in the ostracoderms, so far as known, nor in the modern cyclostomes, were the so-called visceral arches broken up into a system of jointed bars such as we find in the oralo-branchial skeleton of sharks (Fig. 9*C*); and though the endoskeletal tissue from which the Meckelian cartilages were later evolved was probably already present in the ostracoderms, the presence of structures to which the name Meckel's cartilages may be safely applied cannot yet be demonstrated in that group. In the cyclostomes, as

noted above, there is still a possibility that the so-called tongue bar may represent the Meckelian cartilages rather than part of the hyoid arch, but even if this homology were admitted, the entire rasping apparatus of cyclostomes is excessively different from the normal jaws of gnathostomes and there are other good reasons for regarding the cyclostomes as the direct descendants of the ostracoderms and therefore to be classed with them under the term Agnatha.

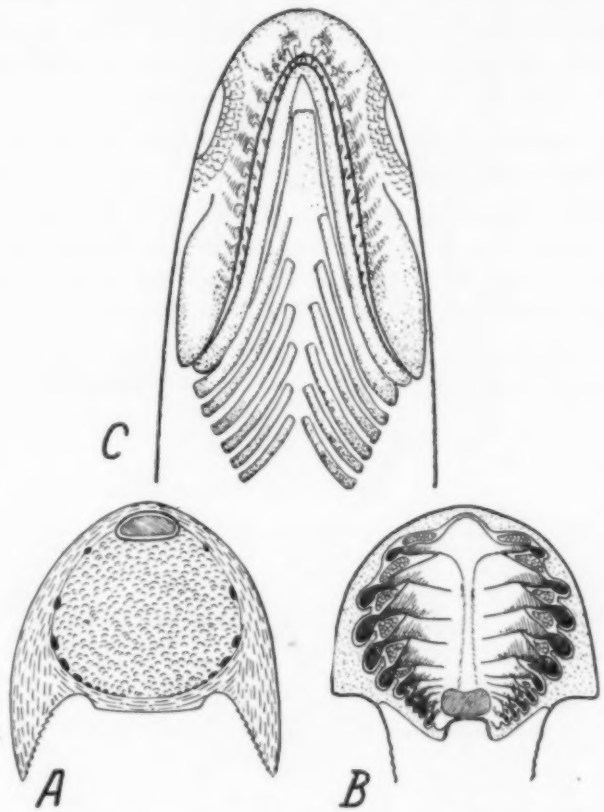


Fig. 9.—Contrast of "jawless" ostracoderm *(A, B)* with well-jawed shark *(C)*. *A*, Under side of head of *Cephalaspis*, showing supposed position of mouth and gill openings. (Restoration after Stensiö.) *B*, Under side of head shield of ostracoderm, showing roof of oralo-branchial cavity with dorsal part of branchial skeleton. None of the gill arches is enlarged to serve as jaws. (Restoration after Stensiö.) *C*, Under side of head of palaeozoic shark (*Cladoselache*), showing enlarged jaws in series with gill arches. (After Dean.) (*A, B.* From Skrifter om Svalbard og Nordishavet, Nr. 12, Part I, 1927. Courtesy of Jacob Dybwad. Reprinted from: *Our Face From Fish to Man* by William K. Gregory, 1929, courtesy of G. P. Putnam's Sons; The INTERNATIONAL JOURNAL OF ORTHODONTIA, ORAL SURGERY AND RADIOGRAPHY 17: 1138, 1931, courtesy of The C. V. Mosby Company; Transactions of the American Philosophical Society, New Series, Vol. 23, 1933. *C.* From Memoirs of The American Museum of Natural History, Vol. 9, Part 5, 1909. Reprinted in *Development of Occlusion*, 1941, courtesy of University of Pennsylvania Press. *A, B, C.* Reprinted in *The Human Face: A Symposium*, 1935, courtesy of The Dental Cosmos; Proceedings of the National Academy of Sciences, Vol. 21, 1935; Biological Reviews, Vol. 11, 1936, courtesy of the Cambridge University Press.)

THE ORAL CAVITY AND JAWS IN ACANTHODIANS AND SHARKS

The oldest known representatives of the Gnathostomata were the acanthodians (Fig. 10), which ranged from upper Silurian to Permian times. In these forms (Fig. 1, *II*) the oral cavity was supported by a set of endoskeletal bars, forming the oromandibular hoop, which was serially homologous with the hyoid and branchial arches of sharks and higher vertebrates; also as in higher vertebrates, the oralo-branchial or visceral arches were composed of jointed pieces.

In the lower invertebrates of many phyla the relatively primitive forms are usually those which have folds around the mouth, bearing lines of cilia for driving toward the mouth a current of water in which bits of food are suspended. This mode of ingestion by means of cilia is perhaps excessively specialized in *Amphioxus* but is retained in a probably less specialized stage in the larvae of the lampreys.

Although we do not yet know the larval stages of the ostracoderms, even the adults of some of them were still in a relatively early stage of adjustment to the habit of predation, which involves the pursuit, the killing, the swallowing and successful digestion of relatively large living prey. From the fundamental similarity between the oralobranchial system of acanthodians and that of modern sharks, we may be sure that even the earliest known acanthodians were already well advanced in the business of predation. Nevertheless they were less perfected in that nefarious profession than sharks are, in several respects. In sharks (Fig. 11*A*) there is so pronounced a differentiation between the oromandibular and the hyoid arch that the former has become exclusively adapted to serve as jaws, while, partly by means of ligaments, the upper segment of the hyoid arch serves to tie the lower jaw to both the upper jaw and the skull.

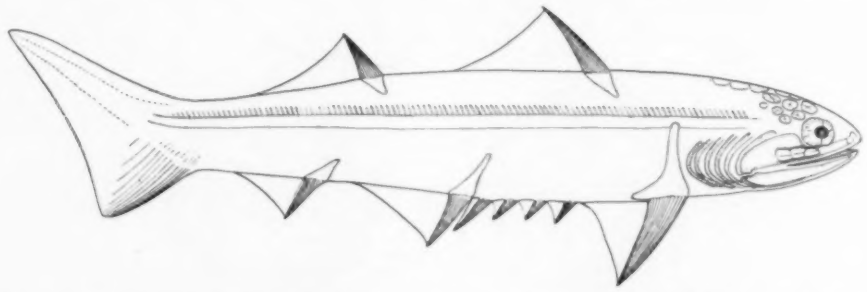


Fig. 10.—A representative (*Climatius*) of the earliest gnathostomes. (After Dean.) (From Memoirs of The American Museum of Natural History, Vol. 9, Part 5, 1909. Reprinted in Proceedings of the American Philosophical Society, Vol. 67, 1928.)

In the acanthodians (Fig. 1, *II*), as Watson has shown, the oromandibular, hyoid and branchial arches were much less unlike each other than they are in sharks and thus they were presumably more primitive. The palatoquadrate bar of each side in the acanthodians was subdivided into two segments corresponding respectively to the two upper segments of the hyoid bar (pharyngohyal and epihyal or hyomandibular), while the Meckel's cartilage or primary lower jaw was likewise composed of two segments, corresponding respectively to the cerato- and basihyal. Second, the hyoid arch was exclusively gill-bearing in function, the hyoidean gill cleft, instead of being limited to the upper part of the arch as in sharks, extended down into the ventral half; nor was the upper segment of the hyoid, corresponding to the hyomandibular, yet specialized as a support for the lower jaw. Moreover it seems very likely that even the oromandibular arch still bore its own half-gill, for the reason that a well-developed flap, corresponding to the flaps that cover the gills in the modern frilled shark and likewise supported by little "opercular rods," was attached to the rear border of the oral arch, while similar but smaller flaps were attached to the hyoid and branchial arches.

Partly because the acanthodians are thus much lower and more primitive than sharks, at least in respect to the construction of their oralo-branchial arches, Watson has proposed for them a new class, Aphetohyoidea (meaning unconcealed hyoids); but it is evident that these aphetohyoids were more nearly related to sharks and other fishes than they were to the ostracoderms.

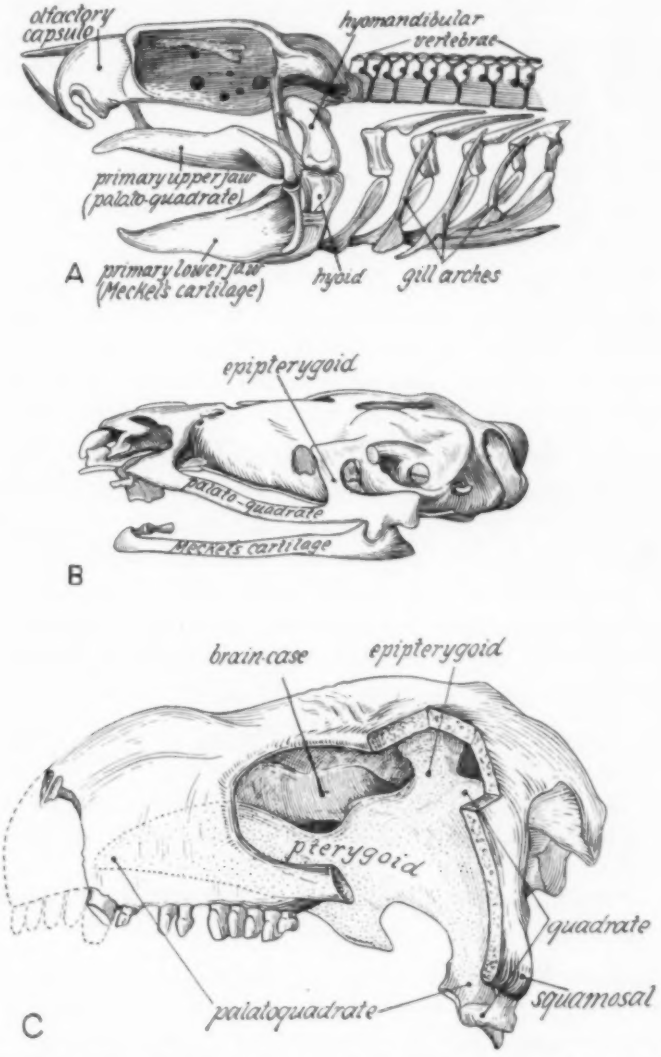


Fig. 11.—Methods of attachment of the primary upper jaw to the under side of the skull. *A*, Hyostylic attachment (by means of the hyomandibular cartilage) characteristic of shark. (After Gegenbaur.) *B*, Autostylic attachment (by means of an epipterygoid process from the primary upper jaw). Cartilaginous braincase and primary upper jaw of fetal salamander. (After Gaupp.) *C*, Skull of primitive fossil reptile *(Diadectes)* from the Permo-Carboniferous of Texas. The bony mask covering the temporal region is cut through and a part of it removed to show the primary upper jaw (comprising the palatine, pterygoid, epipterygoid, and quadrate bones) and their relations to the braincase. (*A*. From *Untersuchungen zur vergleichenden Anatomie der Wirbelthiere.* Drittes Heft: *Das Kopfskelet der Selachier.* . . by Carl Gegenbaur, 1872, courtesy of Wilhelm Engelmann, Leipzig. *B*. From Archiv f. Anatomie u. Entwickelungsgeschichte, Jahrg. 1912, courtesy Von Veit and Company, 1913. *A*, *B*, *C*. From *Our Face From Fish to Man* by William K. Gregory, 1929, courtesy of G. P. Putnam's Sons.)

It has always been assumed that the modern sharks give us a reliable picture of the origin of teeth, since in some sharks we can trace the gradation from the minute shagreen denticles on the surface of the body around the

borders of the jaws to the clusters of teeth inside the mouth. But it is a curious fact that in the older acanthodians, which are both older and in other ways more primitive than the sharks, the teeth are very unlike the scales covering the body. Watson describes the teeth in the primitive acanthodian *Climatius reticulatus* as occurring in little whorls located on the inner margins of the lower jaw, there being no teeth on the upper jaw. The lower dentition "is throughout composed of fused whorls of teeth whose bases coalesce to form a smooth cylindroid surface, which was attached to the oral margin of Meckel's cartilage." Each whorl seems to consist of at least three teeth. They are slightly convex on their outer surfaces and the free extremity of the crown is broken up into three or five needle-pointed cusps by grooves on each surface of the tooth. Such teeth would be useful in grabbing small living creatures, the jaws serving as pincers.

In another early acanthodian, *Ischnacanthus gracilis,* Watson (1937, pp. 79-81) found large backwardly pointed teeth in a single whorl near the front end of the lower jaw. The roof of the mouth and inner sides of the jaw bore rows of small denticles, some with three-point crowns. These teeth of *Ischnacanthus* were much more like those of certain sharks than were the teeth of *Climatius.*

From small whorls somewhat like those of *Ischnacanthus* may have evolved the larger pointed and shearing teeth of sharks. Possibly this dentigerous tissue may have appeared first around the lower jaw and later spread also to the upper jaw. The apparent gradation from dermal denticles into teeth, which is seen on the surface at the corners of the mouth in the modern frilled shark, may more rightly be taken as an example of what has been called secondary polyisomerism, or the tendency of adjacent members of originally different structures to form a transition zone of structurally intermediate or mixed conditions.

A curious fact about the teeth in the earliest fishes is that both teeth and scales were, so to speak, the turned-inside-out cousins of epithelial glands; for although denticles, teeth, and dermal glands all have a central cavity, denticles and teeth secrete skeletal material in and around their own walls, away from the pulp cavity, so that the cavity becomes surrounded by a skeletal structure like a coral and its base, whereas a typical gland pours its product toward its central cavity and away from its walls.

The suggestion that the dentition of sharks may be less primitive than it was formerly thought to be seems to become more probable when we reflect that whereas the sharks used to be regarded as almost ideally primitive vertebrates, they are more recently coming to be thought of as in some respects retrogressive (as in the retention of a largely cartilaginous skeleton). Again, the sharks are peculiar and possibly retrogressive in the fact that they lack a sheath or covering of derm bones on the roof of the mouth and on the outer and inner sides of the lower jaw. For whereas in the sharks the teeth rest directly on the oral bars or primary upper and lower jaws, in higher fishes the tooth-bearing patches are located on strong derm bones. The beginning of this system of "secondary" or outer jaw bones is seen in certain acanthodians, e.g., *Climatius reticulatus* (Watson, 1937, p. 54) at which stage the teeth and their supporting plate were continuous with each other and with the underlying Meckel's cartilage.

THE JAW COMPLEX OF LATER VERTEBRATES

These three elements are completely differentiated from each other in the oldest known forerunners of the bony fishes, which were the crossopterygians (or rhipidists) and palaeoniscoids of the Devonian period. From this point onward the general story of the evolution of the bony face, including jaws and teeth, has often been told and need be only summarized here. It may suffice to note that even in the lobefins (Fig. 1, *III*), or crossopterygians, which were probably equipped with lungs as well as with gills, there were not less than eighteen named bones (Fig. 12, *A*, *B*) composing the mandible alone; whereas in the human adult as in the higher apes there is only a single bone, the mandible, formed by the fusion of the right and left dentary bones. A similar drastic reduction in number of bones, together with a progressive differentiation of those that remained, took place in the upper jaw, including the bony palate (Fig. 16); but this phase of the subject is summarized in the final outline.

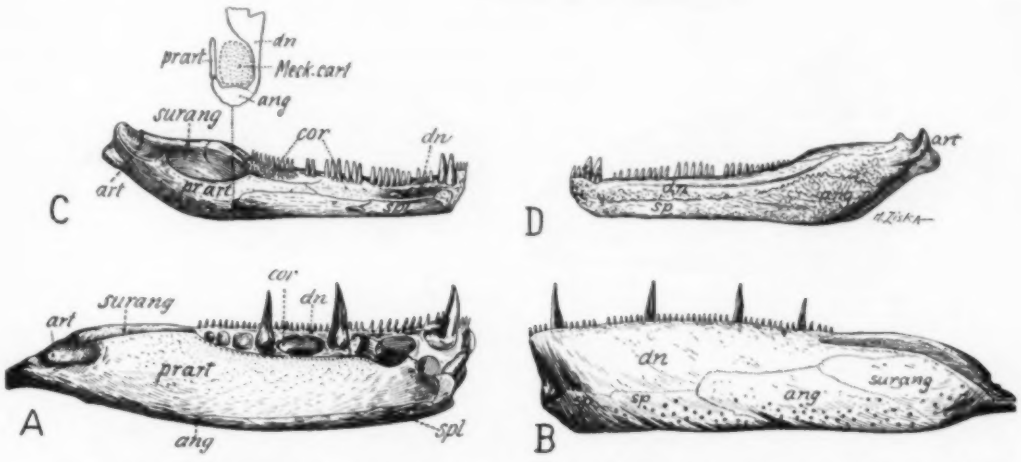


Fig. 12.—The many-pieced mandible of a lobe-finned fish and an early amphibian. *A* (inner) and *B* (outer) view of jaw of *Megalichthys*. (Mainly after Watson.) *C* (inner) and *D* (outer) view of jaw of Trimerorhachis. (After Williston.) (*A*, *B*. From Philosophical Transactions of the Royal Society of London, Series B, Vol. 214, 1926. *C*, *D*. From Journal of Geology, Vol. 21, 1913. *A*, *C*. Reprinted in Biological Reviews, Vol. 11, 1936, courtesy of the Cambridge University Press; *Development of Occlusion*, 1941, courtesy of the University of Pennsylvania Press. *A*, *B*, *C*, *D*. The INT. J. ORTHODONTIA, ORAL SURGERY AND RADIOGRAPHY **17**: 1138, 1931, courtesy of The C. V. Mosby Company.)

MUSCLES OF THE FACE AND JAWS

But what of the history of the muscles, glands, blood vessels, nerves, and other soft parts with which at all stages the oral cavity has been plentifully supplied? In man (Fig. 13*E*) and many other mammals the mouth and oral cavity are so completely surrounded by the labile lips, cheeks, and tongue and by the soft palate that we might at first expect to find the very early ancestors of man already clothed in a similar mobile facial mask. But all the facts indicate that this stage was first attained in the ancestral mammals, after the sphincter colli profundus of the lizard-like ancestors of the mammals had crept forward between the skin and the bones and become differentiated into muscular streams that surrounded the ears, eyes, forehead, cheeks, lips, and throat. Thus the region of the lips and cheeks in man represents a new extension to the oralo-branchial system, beneath which the old surface bones lie buried.

Prior to that revolutionary development, our ancestors had worn an immobile and bony facial mask (Fig. 13*A;* Fig. 1, *IV, V*) covered with a tough reptilian epidermis; and in still earlier stages the lateral surfaces of the bones that correspond to our superior and inferior maxillae lay wholly on the surface, as in the oldest ganoid fishes (Fig. 1, *III*) and were covered with a shiny enamel or ganoine. Before that, in turn, was the head-armor of the oldest ostracoderms, and again before that, probably the little plaques of the common ancestors of the chordates and echinoderms.

Before jaw muscles appeared as such they had served a long apprenticeship as part of the constrictors of the branchial basket (Fig. 14), and since they are

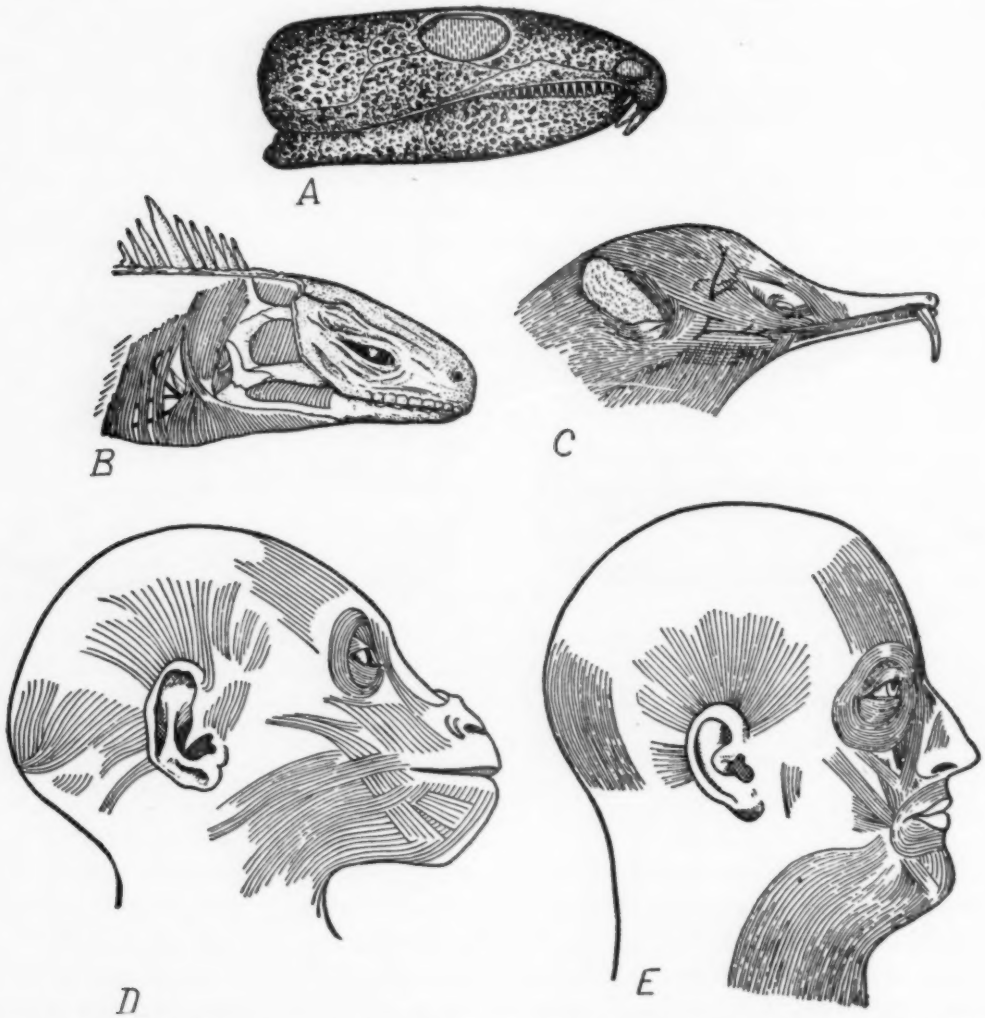


Fig. 13.—Origin of the facial muscles of man. *A*, Primitive reptile *(Labidosaurus)* with continuous bony mask covering skull. (After Williston.) The mask was covered with thick skin without muscles, as in the alligator. *B*, Modern reptile *(Sphenodon)* with an open or fenestrated skull covered with thick, nonmuscular skin. The seventh nerve (heavy black line) is seen beneath the sphincter colli muscle, a broad band around the throat. (From Fürbringer, modified from Ruge.) *C*, Primitive mammal *(Echidna)* in which the sphincter colli system has grown forward over the face. D, Gorilla. *E*, Man. (*C, D, E*, all after Ruge.) (*A*. From The Osteology of the Reptiles, 1925, courtesy of the Harvard University Press. *B*. From Jenaischen Zeitschrift f. Naturwissenschaft, 34 Bd, 1900, courtesy of Gustav Fischer. *C, D, E*. From *Untersuchungen u. d. Gesichtsmuskulatur d. Primaten*, 1887, courtesy of William Engelmann. *A, B, C, D, E*. Reprinted in *Our Face From Fish to Man*, by William K. Gregory, 1929, courtesy of G. P. Putnam's Sons.)

voluntary muscles, their ultimate derivation may have been from strips of the locomotor muscles, which, as in the modern cyclostomes, extend both dorsally and ventrally to the branchial basket.

THE ORALO-BRANCHIAL CAVITY AND RESPIRATION

As to the history of the cranial nerves, especially of those supplying both the sensory and motor parts of the jaws and branchial apparatus, very definite and welcome information has been furnished by Stensiö, who has explored the surprisingly well-preserved grooves and tunnels which mark the course of the nerves and blood vessels that traversed the endoskeletal tissue in the head-shields of the cephalaspid ostracoderms. By comparison with Johnston's thorough reports on the cranial nerves of the living cyclostomes, Stensiö was able to establish that in the cephalaspid ostracoderms the general pattern of the cranial nerves was even more primitive than it is in the cyclostomes. The evidence from the cranial nerves and blood vessels fully confirms the generalization that the jaws of primitive gnathostome vertebrates represent highly specialized gill-arches and therefore that originally the processes of breathing and feeding were much more closely connected than they are now.

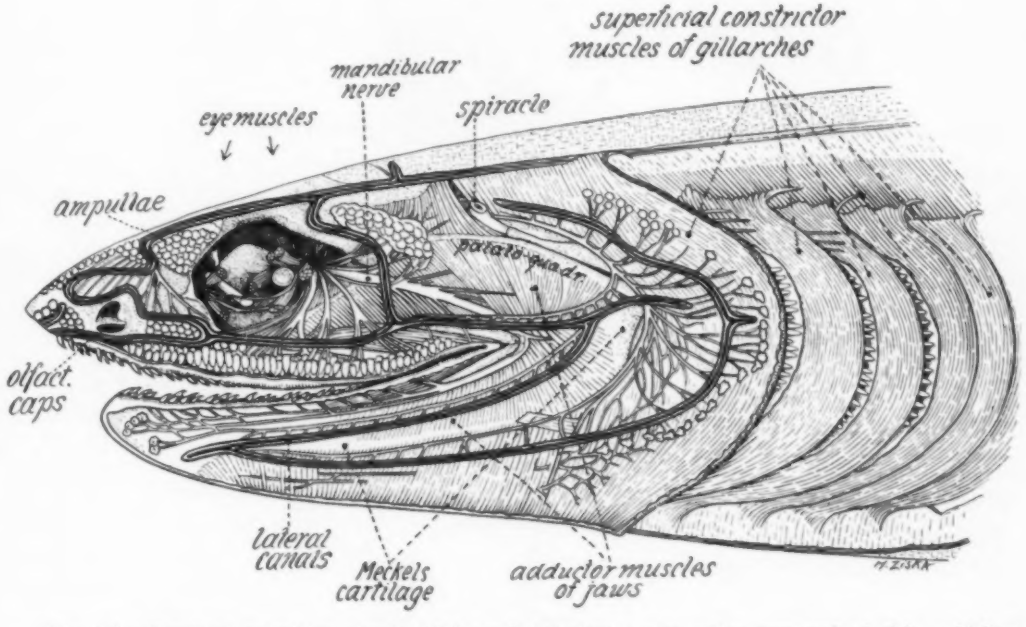


Fig. 14.—Head of primitive shark *(Chlamydoselachus)*, seen after removal of skin. (After Allis.) Lateral line canals black, bordered with white; nerves white; muscles streaked; cartilage stippled. (From Acta Zoologica, Bd. 4, 1923, courtesy Internationell Tidskrift för Zoologi utgiven av Nils Holmgren. Reprinted in: *Our Face From Fish to Man* by William K. Gregory, 1929, courtesy of G. P. Putnam's Sons; Transactions of the American Philosophical Society, New Series, Vol. 23, Part 2, 1933, courtesy of the American Philosophical Society.)

This introduces the problem of the origin of lungs. It has long been known that the lungs of amphibians and higher vertebrates are homologous with those of lungfishes and with the air sacks of fishes. From the position of the narial openings in the Devonian lobefin fishes, which were the same as in the lungfishes and earliest amphibians, it is inferred that the lobefin fishes also were provided with both lungs and gills. Dr. Robert Denison of Dartmouth College, from a careful study of the natural casts of the internal organs

of *Bothriolepis,* a Devonian fish of the placoderm group (Fig. 15), has discovered clear evidence of two good-sized sacks corresponding to the lungs of dipnoans lying behind the transverse septum or primitive shoulder girdle and continued forward by ducts that open on the floor of the mouth. "It might be hoped that *Bothriolepis,* since it has the earliest known lungs, would furnish evidence on the manner in which lungs originated, whether as independent esophageal diverticula or as modified gill pouches. All that can be said, however, is that there is no evidence in *Bothriolepis* of serial homology between the lungs and gills. Moreover, if such a homology existed, it is possible that it was already masked by specializations correlated with the shortness and breadth of the head" (Denison, 1941, p. 559). This fish is also especially interesting in the present connection because it shows an early stage in the integration of primary and secondary (superficial and deep) jaw elements.

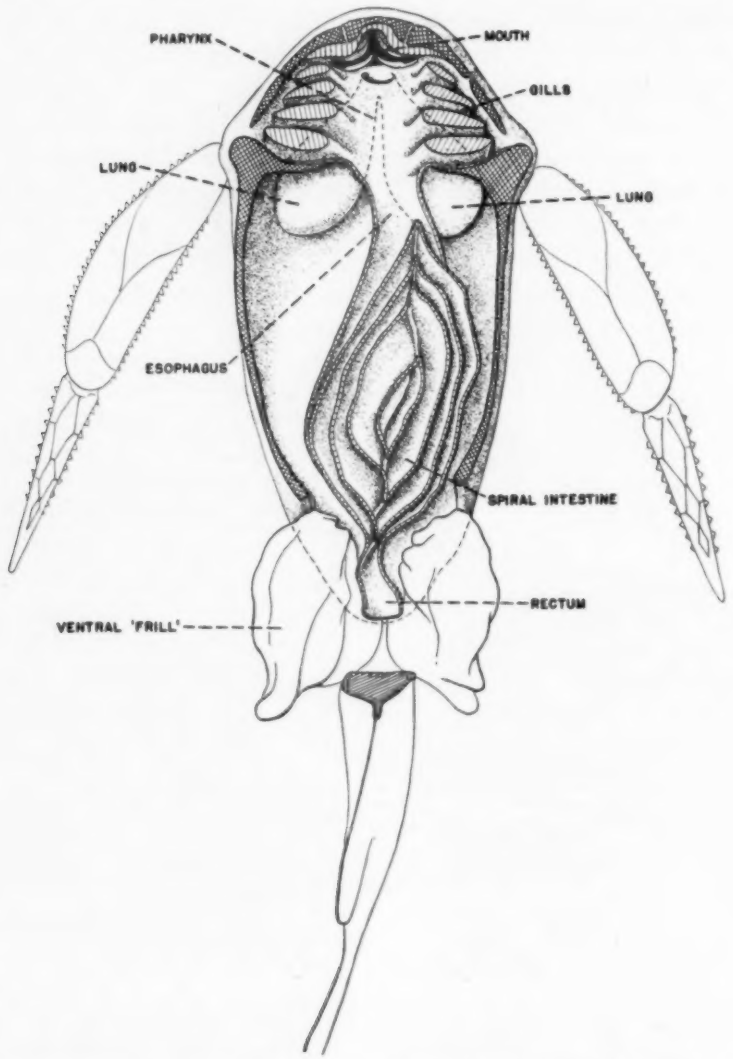


Fig. 15.—Reconstruction of Devonian armored fish (*Bothriolepis*), showing relation of the jaws to the oralo-branchial chamber. (After Denison, 1941.) (From Dartmouth College Museum Report for 1940, courtesy of Dartmouth College.)

The separation of a special respiratory channel from the roof of the mouth occurred by the folding over of flanges extending inward from the premaxillae, maxillary and palatine bones. This change may be closely followed in the fossil series from fish to mammal-like reptiles, thence to the lower mammals and on to man (Fig. 16).

Another sack which originally opened into the roof of the mouth was that of Jacobson's organ (Fig. 17), an accessory olfactory organ serving to test the food substances in the mouth (Noble, 1931, p. 325), but which has become vestigial in man and some other mammals. Still another was the pituitary—originally an inpushing of the ectoderm in the lamprey and probably also in the cephalaspid ostracoderms. This grew forward and upward on to the roof of the skull but in higher vertebrates became connected with the infundibulum of the brain.

The ectoderm of the stomodaeum is also the fertile parent of various kinds of glands: mucous, salivary, parotid, etc., some of which likewise may be traced among living forms from the cyclostomes upward.

MAIN DIVISIONS OF THE ORALO-BRANCHIAL COMPLEX

In brief, the evidence from comparative anatomy, paleontology and phylogenetic taxonomy joins with the embryologic evidence to support the following subdivisions of the oralo-branchial complex.

A. Labio-buccal or vestibular division: of secondary, mammalian origin, enclosing (B) the stomodaeal cavity by forward growth of the facialis muscles to form the lips and cheeks (Fig. 18).

B. Oral or stomodaeal division: bounded posteriorly by the "oral plate" of the embryo; including the jaws, teeth, and palate; surfaced by epithelial epiblast derived from the stomodaeum.

C. Pharyngeal or branchial division: representing the anterior division of the primitive gut and its branchial diverticula, but surfaced in part by epiblast brought in by pockets from the outside which meet the outpockets from the gut to form the gill clefts.

In the primitive ancestral fishes divisions B and C formed the oralo-branchial chamber of the adult (Fig. 1, *I*) and as the "primitive jaws" were serially homologous with gill clefts (Fig. 1, *II*), so too the median stomodaeum seems to be homologous with a pair of branchial inpockets.

SUMMARY

I. In accordance with much evidence we may assume that at some extremely remote time (Fig. 22), long antecedent to the Basal Cambrian (550,000,000 years ago), single-celled organisms subdivided into many-celled forms, some of which later gave rise to two-layered basal coelenterates (of which hydroids and jellyfishes are modern representatives). At this stage the pouch-like gastraea appeared; its single opening or prostoma, which led to the primitive food bag, was homologous not with the mouth but with the anus of vertebrates. True homologues of the vertebrate mouth are not to be found in any of the annulated, articulated, or arthropod invertebrates.

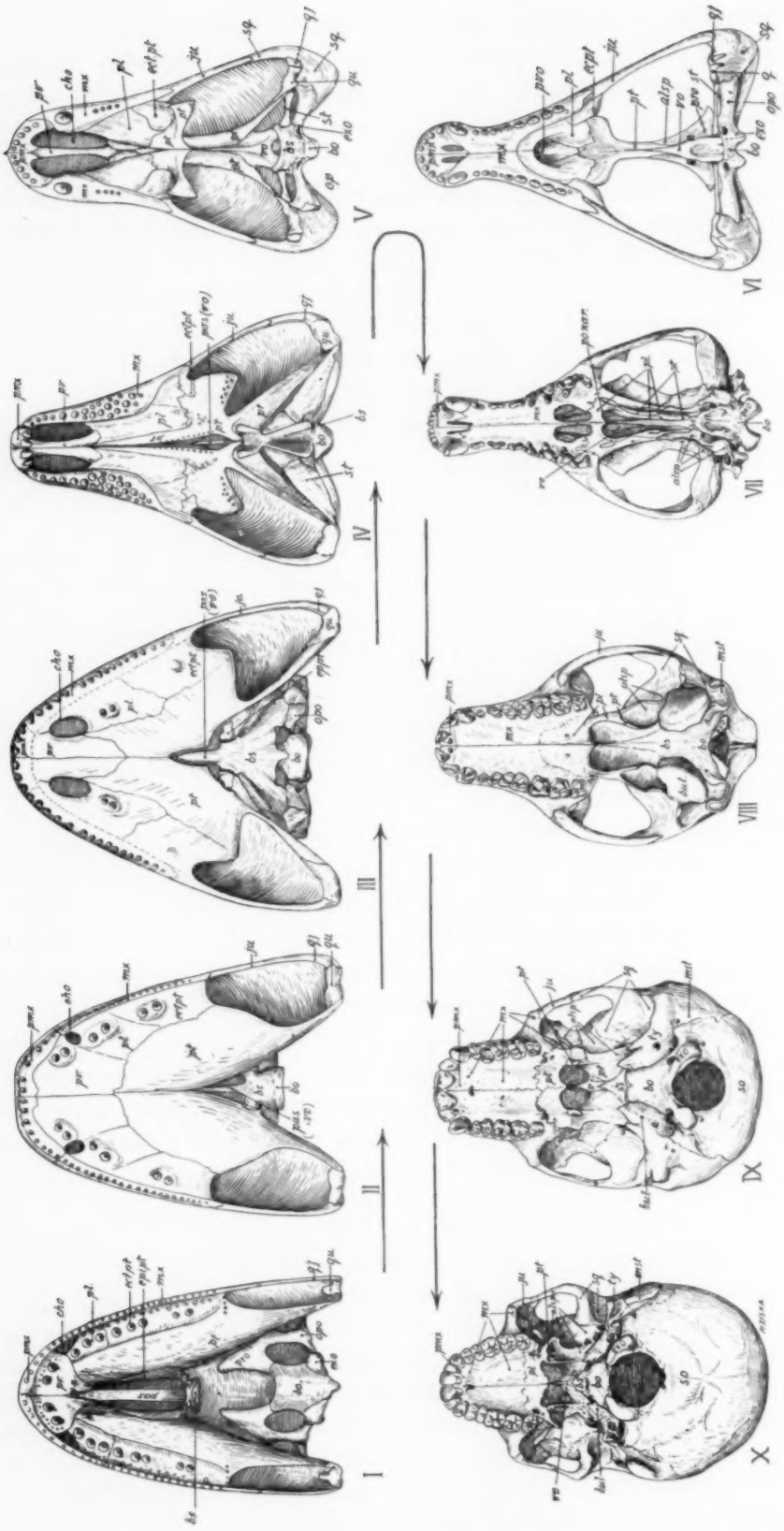


Fig. 16.

(For legend see opposite page.)

II. In the remote common ancestor of the echinoderms and chordates the beginnings of the vertebrate mouth were represented by a stomodaeal inpushing in a *Tornaria*-like, floating sacklike organism feeding by ciliary ingestion (Fig. 1*D*).

III. The oldest known fossil chordates, which are the ostracoderms (Fig. 1, *I;* Fig. 7) of the Silurian and Devonian periods, had already settled down on or near the sea bottom and had acquired an oralo-branchial chamber with a stomodaeal mouth pouch and a series of large paired gill pouches. The endoskeletal tissue of the head was diffuse, not subdivided either by sutures or articulations. The floor of the throat, probably moved by slips of the locomotor muscles, pumped in small food. The more advanced ostracoderms (Anaspida) may have pursued small prey, seizing them by means of a bony knob at the end of the lower lip, but complex jaws with inner and outer skeletal parts had not yet been evolved.

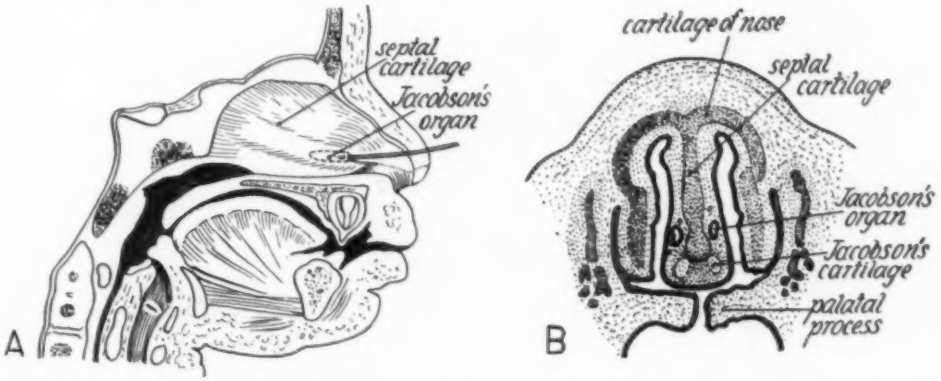


Fig. 17.—Jacobson's organ in the human fetus. *A*, Location of Jacobson's organ. The sound is inserted into the opening of the organ. *B*, Frontal section of fetal human nose, showing vestige of Jacobson's organ. (*A* and *B* after Corning.) (From *Lehrbuch der Entwicklungsgeschichte des Menschen* by H. K. Corning, 1925, courtesy of J. F. Bergmann. Reprinted in *Our Face From Fish to Man* by William K. Gregory, 1929, courtesy of G. P. Putnam's Sons.)

IV. The acanthodians (Fig. 10) were predatory, swift swimmers, with complex jaws, the inner jaws being derived from gill bars (Fig. 1, *II*). The endoskeletal tissue around the oral pouch was already segregated into articulated pieces, the primary upper and lower jaws, while the tissue between the hyoid and branchial sacks had already given rise to articulated bars of the hyoid and branchial arches. The hyoid arch was a complete gill-bearer and no part of it had been modified for the support of the jaws. At this and the next stage

Fig. 16.—Evolution of the skull in *norma basalis*. *I*, Devonian lobe-finned ganoid, *(Eusthenopteron)*. (Figure from Watson, chiefly after W. L. Bryant.) *II*, Lower Carboniferous embolomerous amphibian *(Eobaphetes)*. (After Watson.) *III*, Primitive Permo-Carboniferous reptile (*Seymouria*). (Figure from Watson; data from Broili, Williston, Watson.) *IV*, Advanced cotylosaurian reptile of the Permian (*Captorhinus*). (Figure and data from specimen; data also from Broom, von Huene, Sushkin.) *V*, Primitive mammal-like reptile of the Middle Permian *(Scylacops)*. (Figure and data from Broom.) *VI*, Advanced mammal-like reptile of the Triassic *(Cynidiognathus)*. (Figure from Broom; data from Seeley, Haughton, Broom.) *VII*, Modern marsupial mammal *(Thylacinus)*, representing a survivor of Cretaceous marsupial stock. (Figure and data from specimens.) *VIII*, Eocene lemuroid primate *(Adapis)*. (Figure and data from Stehlin.) *IX*, Chimpanzee, a little-modified survivor of the Miocene anthropoid stock. (Figure and data from specimen.) *X*, *Homo sapiens*, represented by aboriginal Australian, survivor of Pleistocene man. (*I, II.* From Philosophical Transactions of the Royal Society of London, Vol. 214, 1926. *III.* From Proceedings of the Zoological Society of London, 1919, courtesy of the Zoological Society. *V.* From Proceedings of the Zoological Society of London, 1913, courtesy of the Zoological Society; *VI.* From Philosophical Transactions of the Royal Society of London, Series B, Vol. 218, 1930, courtesy of the Royal Society. *VIII.* From Abhandlungen d. schweizerischen paläontologischen Gesellschaft, Vol. 38, 1912, courtesy of Zürcher und Furrer. *I-X.* From The Quarterly Review of Biology, Vol. 4, 1929, courtesy of Williams and Wilkins Company.)

(Fig. 1, *III*) the future derm bones of the face were still on the surface and covered with enamel or a ganoine-like layer. The teeth were already differentiated from dermal denticles.

V. In the oldest known ganoid fishes the primary jawbones (Fig. 1, *III*) were covered by superficial dermal plates, surfaced externally with ganoine and bearing an incrustation of teeth. These surface plates were closely appressed to the old primary jaws (palato-quadrate, Meckel's cartilage). Thus arose the complex jaws of the higher vertebrates. When certain air-breathing fishes began to come up on land, their teeth and jaws were still essentially like those of the oldest ganoids.

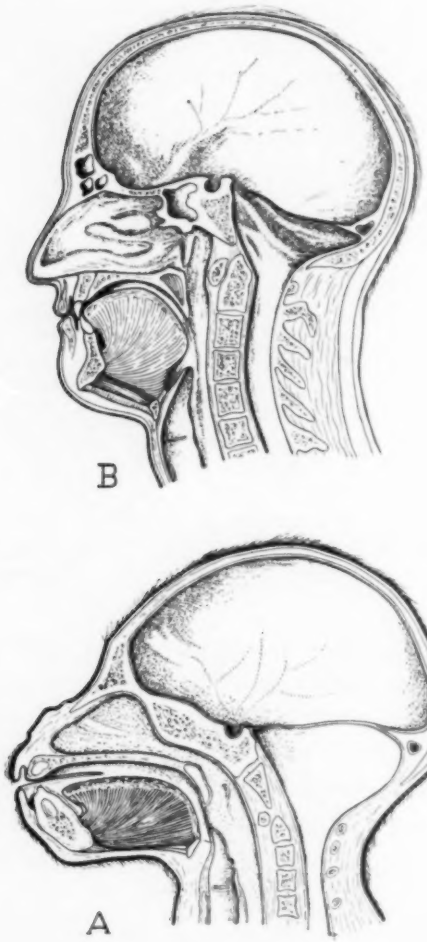


Fig. 18.

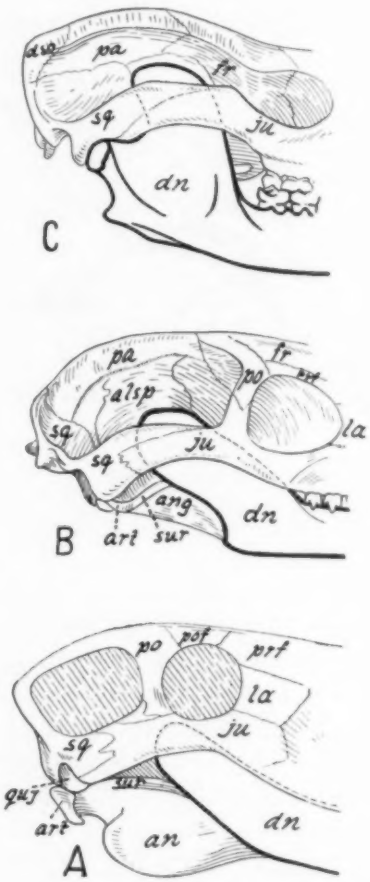


Fig. 19.

Fig. 18.—Longitudinal section of head in young gorilla (*A*) and in man (*B*), showing relation of tongue to surrounding parts. (After Klaatsch.) (From *Entstehung und Entwickelung des Menschengeschlechtes by* Hermann Klaatsch, courtesy of Weltall und Menscheit (Hans Kraemer), Berlin. Reprinted in *Our Face From Fish to Man* by William K. Gregory, 1929, courtesy of G. P. Putnam's Sons.)

Fig. 19.—Progressive upgrowth of the dentary bone of the lower jaw to form a new joint with the skull. *A*, Primitive mammal-like reptile *(Scymnognathus)*. (After Broom.) *B*, Advanced mammal-like reptile *(Thrinaxodon)*. (After Broom.) *C*, Primitive mammal (*Thylacinus*). (From specimen). (*A*. From Bulletin of the American Museum of Natural History, Vol. 25, 1915, courtesy of the American Museum. *B*. Proceedings of the Zoological Society, London, 1912, 1926, courtesy of the Zoological Society. *A, B, C*. In *Our Face From Fish to Man* by William K. Gregory, 1929, courtesy of G. P. Putnam's Sons. Reprinted in *Development of Occlusion*, 1941, courtesy of University of Pennsylvania Press.)

VI. In the line of the mammal-like reptiles (Fig. 19) one pair of the surface bones of the mandible, the dentaries, became dominant, the ascending rami of the opposite dentaries grew upward toward the squamosal bones bordering the primary upper jaw until they came near to the squamosal portion of the temporal complex.

VII. As the mammalian grade was reached, the temporomandibular joint came into being, the jawbones behind the dentary became reduced and were taken over into the middle ear (Fig. 20), while the pterygoid part of the upper jaw dwindled into slender slips, forming the medial pterygoid lamina of the sphenoid (Fig. 16, *VII* to *X*).

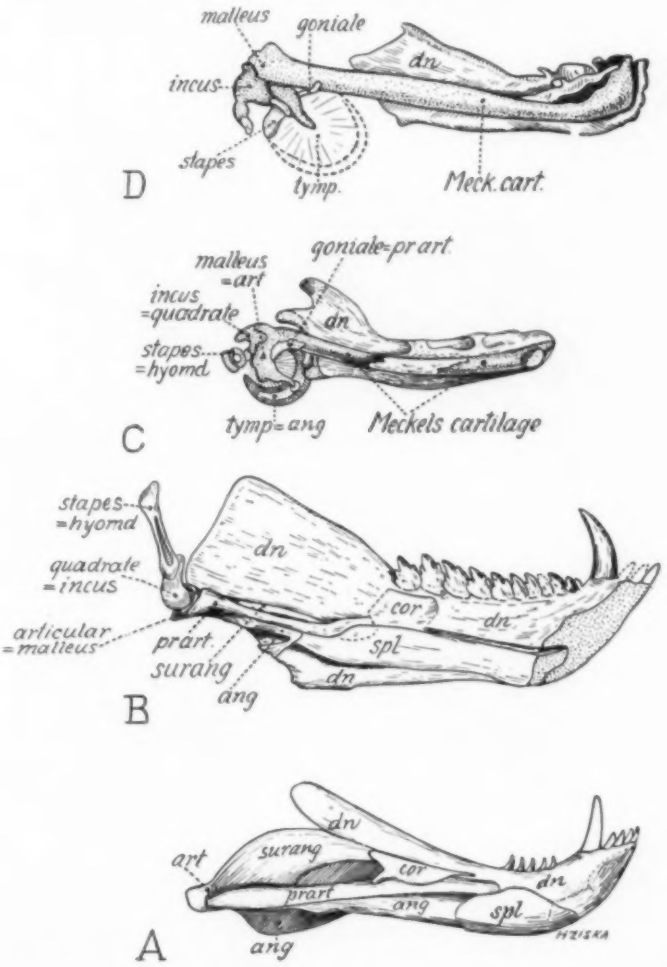


Fig. 20.—Transformation of the postdentary jaw elements into auditory ossicles. *A*, Primitive theriodont, *Cynarioides*. (After Broom.) Ascending ramus of dentary conspicuous. *B*, Progressive cynodont, *Cynognathus*. (Modified from Broili, by addition of quadrate and stapes from other specimens.) Ascending ramus of dentary very large, other elements reduced. *C*, Fetal mammal, *Erinaceus*, showing relatively large size of malleus and incus. The malleus is formed from the proximal end of Meckel's cartilage. (After W. K. Parker.) *D*, Fetal man, showing connection of auditory ossicles with Meckel's cartilage. (After Macklin.) (*A*. From Philosophical Transactions of the Royal Society of London, Series B, Vol. 218, 1930, courtesy of the Royal Society. *B*. From Sitz. der Bayerischen Akademie der Wissenschaften, 1934, courtesy of the Bayerischen Akademie. *C*. From Philosophical Transactions of the Royal Society of London, Part 1, 1885, courtesy of the Royal Society. *D*. From Publication 273, Contributions to Embryology, No. 48, 1921, courtesy of the Carnegie Institution of Washington. *A*, *C*, *D*. Reprinted in The Int. J. Orthodontia, Oral Surgery, and Radiography **17**: 1138, 1931, courtesy of The C. V. Mosby Company. *C*, *D*. Reprinted in *Our Face From Fish to Man*, by William K. Gregory, 1929, courtesy of G. P. Putnam's Sons. *A*, *B*, *C*, *D*. Reprinted in Biological Reviews, Vol. 11, 1936, courtesy of the Cambridge University Press.)

Meanwhile part of the sphincter colli profundus spread forward over the face, lips, cheeks and throat, forming a mobile mask (Fig. 13) which completely covered the old "fish-trap" bones (premaxillae, maxillae, dentaries), while transverse flanges from the maxillae and palatines formed a secondary palate to lead the inspired air back to the trachea (Fig. 16). The tongue (Fig. 21), inherited from the floor of the hyobranchial skeleton of the fish, became over-

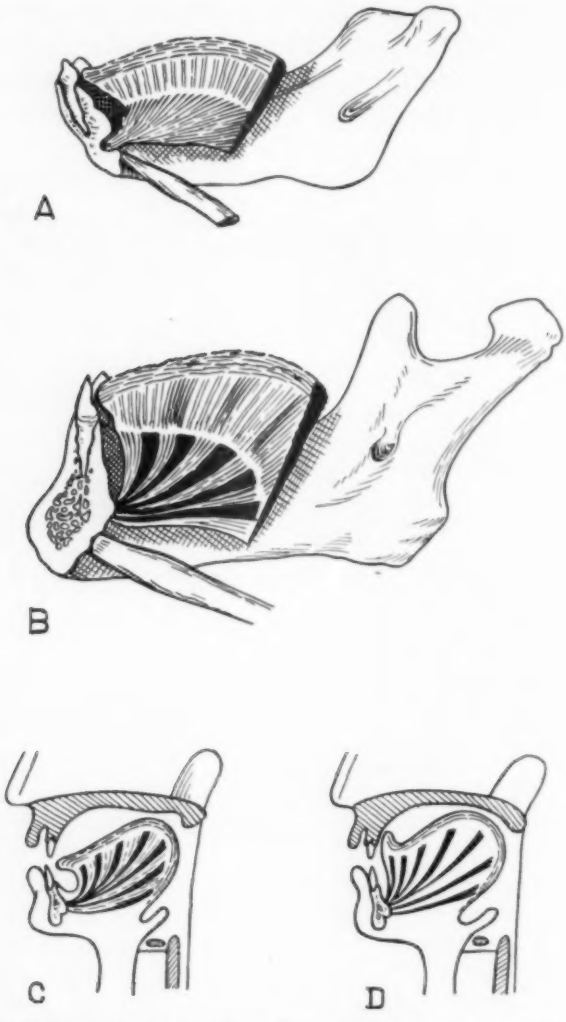


Fig. 21.—Longitudinal section of lower jaw of monkey (*A*) and man (*B*), showing attachment of the tongue muscle to the back of the jaw. (All after Robinson.) In *B* the subdivision of the tongue muscle into strands is overemphasized in order to show how the upper surface of the tongue could be thrown into different contours by the contraction of different strands of the genioglossus muscle. *C*, Diagram of the genioglossus muscle in pronouncing the sound "oo." *D*, Diagram of the genioglossus muscle in pronouncing the letter "T." (From The Story of the Chin by L. Robinson, 1913, courtesy of *Knowledge*. Reprinted in *Our Face From Fish to Man* by William K. Gregory, 1929, courtesy of G. P. Putnam's Sons.)

laid with thick, actively moving muscle layers. The teeth, now masked and covered by surrounding structures, represent long persistent holdovers from the ancient days when they, in common with the long-lost ganoid scales, were exposed on the lateral surfaces of the head.

Thus the complexities of the human oral cavity have resulted from its long and intricate history, which is a part of the vast picture of the Tree of Life

(Fig. 22), the understanding of which is now slowly emerging as the resultant of thousands of contributory studies in systematic zoology, embryology, comparative anatomy and paleontology.

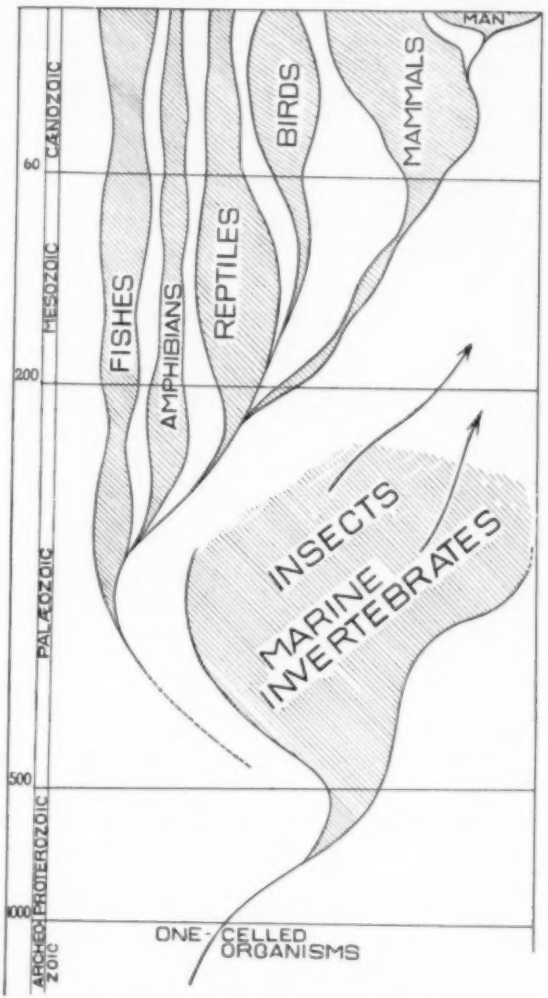


Fig. 22.—The Rise of the Vertebrates in Geologic Time. Figures at left give estimated time in millions of years. (From *Our Face From Fish to Man* by William K. Gregory, Courtesy of G. P. Putnam's Sons.)

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ALTERATION OF OCCLUSAL RELATIONS INDUCED BY EXPERIMENTAL PROCEDURE

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INTRODUCTION

THE adaptability of the animal body and particularly of the animal skeleton to changes of function has been universally recognized by biologists. Authors who have contributed to this knowledge include Georges Cuvier,[1] Charles Darwin,[2] Wilhelm Roux,[3] and E. S. Russel.[4*]

This quality of mutability has also long been emphasized in literature dealing with the human dental apparatus. It would seem idle to produce further proof of the influence exerted upon the shape of the human jaws by the forces which act upon them, including muscular forces, were it not for the repeated appearances in dental publications of remarks like the following:

> "The form and proportions of the human mandible are determined at a very early age *and, once established, do not change.*
>
> "The position of the mandible in relation to the rest of the face and head is an integral part of the pattern of the individual and is just as *unchangeable as is form*" (italics mine).[5]
>
> "The size and shape of the basal bone cannot be altered very materially by treatment as this is determined predominantly by the genetic factor. The disposition of the alveolar process can be changed quite considerably by mechanical means. . . ."[6]
>
> "Any effort to change the operation of the temporomandibular joint places a strain on the muscles of mastication and, in order that this be relieved, the adaptable alveolar bone resorbs until the joint is once more in its normal position.
>
> "We also know that a change in the rami would be necessary and that this cannot take place."[7]
>
> "In correcting malocclusion, the only change we make is in the alveolus. We cannot, with orthodontic appliances, lengthen or shorten the mandible, and we cannot change the temporomandibular joint."[8]
>
> ". . . it is convincing that, granting the correction of the malarticulation of the teeth which is accompanied by some change in the alveolar process, there is little alteration in the bony contours."[9]
>
> "The effect of orthodontic appliances influences unfavorably the roots of the teeth and the tissues surrounding them. The result aimed at and frequently attained is normal occlusion. Whatever else happens in the course of orthodontic treatment such as increase in size, change in form and alteration in the position of the jawbones and the rest of the face is due to conditions over which our mechanical devices have *no influence and no control.*"

Read before the New York Society of Orthodontists, March, 1943, New York City.

*Charles Darwin: in *The Origin of Species* on "correlated variations":

". . . that the whole organization is so tied together during its growth and development, that when slight variations in any one part occur, and are accumulated through natural selection, other parts become modified."

Wilhelm Roux: in *Der Kampf der Theile im Organismus:*

"Oft-repeated exercise or heightened exercise of the specific functions, or repeated action of the functional stimuli which determine them, produces, as we have said before, true form changes as a by-product . . . . . Insofar as these form changes facilitate the repetition of the specific functions, I have called them functional adaptations."

This last statement would leave open the possibility of influencing the jawbones and face by means other than mechanical devices. That, however, is not what the author has in mind since this article ends:

> ". . . We must be mindful of two facts: namely, that while mechanics furnishes the means by which the possibilities of orthodontic practice are realized, biology reveals a *boundary of limitations within which our practice must be confined.*"[10]

These quotations from recent orthodontic literature argue that the hereditary factor alone determines the shape and relation of the jawbones. It is, of course, indisputable that the hereditary factor determines the form of an organ, i.e., in our specific case: a human mandible will always develop into and retain the form of a human mandible despite all functional, environmental, or other influences. But this fundamental biologic concept does not justify the conclusion that the predetermined form of the organ cannot be *modified* by other factors during development and even after.

Moreover it is claimed that only the alveolar bone reacts to therapeutic efforts. This denial of any possibility of influencing the jawbones proper serves as an excuse for the contemporary trend of orthodontic therapy; that is, the concentrating upon the finding of new, or perfecting of old, mechanical devices which act mainly on the alveolar processes. This trend represents an unfortunate lack of intention to deal with the origin and basic nature of dental malformations.

The influence of any orthodontic treatment on areas other than the alveolar process, such as the condyle, ramus, fossa, angle, etc., was established histologically in a series of experiments[11] performed with the original intention of studying the skeletal changes which accompany orthodontic treatment. These findings were published years ago but they have not been regarded as conclusive by those investigators who claim the immutability of the jawbones. Some considered the described bone transformations merely microscopic and too minute to be of clinical significance, particularly since serial x-rays taken at regular intervals from patients treated with conventional appliances did not appear to reveal clinically measurable changes in the shape of the jaws. In addition, cephalometric studies on growing children were made with the same x-ray methods and furnished alleged proof of the constancy of angles and bone relations of the skull.[12] Even the extraction of teeth, or the placing of bite-raising appliances, has been considered as affecting the alveolar process alone, and any extra-alveolar influence has been denied. (See quotations.[6-10]) These contentions disregard the clinical experience of prosthodontists and the published histologic proof that extraction by itself causes significant bone transformations in the temporomandibular joint.[11] This school of thought submits the adaptability of the alveolar bone alone as sole basis for all orthodontic treatment. This self-imposed limitation is a corollary to the idea that the alveolar bone differs in its reactions from any other bone in the body, a hypothesis for which there is no necessity and, moreover, no proof. The situation is such that the researchers in and practitioners of orthodontics are continually encouraged to consider only the alveolar process as their field of action, and to concentrate on the improvement of "braces" rather than on their elimination.

This conventional orthodontic therapy embraces a limited field of action. It is helpless before inexplicable failures, and the constantly threatening danger of relapse. These unsolved difficulties may very well be the consequence of a purely mechanical therapy which concentrates on shifting of teeth, disregarding in most cases origin and nature of the disease, and disregarding even an important part of the field of operation itself, namely, the jawbones as distinguished from the alveolar process.

It is for these reasons that experimental results are herewith presented, to furnish new, indubitable proof, if such proof be needed, that the shape and relation of jawbones are readily modified under the influence of altered forces acting upon the skeleton. In these experiments a complete and lasting change in occlusion was accomplished and, in one instance, without influencing the teeth or the alveolar process, but merely by disturbing the balance of muscular forces. If it is possible to induce such a transformation, should this not serve as a signpost toward a broader conception of orthodontic therapy?

DESCRIPTION OF EXPERIMENTS

Experiment No. 1.—In a mature, female, *Macacus rhesus* monkey 1 c.c. of 98 per cent alcohol was injected, under general anesthesia, into the region of the sphenomaxillar fossa on both sides, with the intention of reaching the Gasserian ganglion. The purpose of the injection was to paralyze the third division of the fifth nerve, whose motor root supplies masseter, internal and external pterygoid, and temporalis muscles. The expectation was that the disturbance of the balance between muscular forces acting upon the mandible would induce an adaptation and transformation of this bone to the new arrangement of forces. Such adaptations are known to occur throughout the skeleton, and it was of interest to determine the clinical result of such bone metamorphoses on the masticatory apparatus.

Models and x-rays of the animal were taken before starting the experiment (Figs. 1 and 2).

As a result of the injection the animal's ability to bite hard food was greatly impaired, to the extent that she was unable to eat hard bread or crackers without first soaking them in water to soften them.

A re-examination of the animal after seventy-two days revealed the complete change in occlusion shown in the illustrations (Figs. 3 and 4). The bite was open about three millimeters in the front, and the relation of the upper and lower molars and premolars was changed, the lower dental arch biting the width of one cusp mesially (Angle Class III) from its former, normal position. It was impossible to push the mandible into its original position. At this time new x-rays and impressions were taken.

This new relation between upper and lower jaws has remained unchanged to this date, which is a year and a half after the injection was made. It is still impossible to push the mandible back to its original position. The animal has since regained its biting power and the open-bite has closed. Plaster impressions, photographs and x-rays taken one year after the injection are shown (Figs. 5, 6, 7, 8, and 9). Fig. 10 shows the relation of the molars while the condyles rest in the fossa.

The experiment is being repeated for the purpose of histologic investigation. The clinical result of the experiment permits the conclusions which will be offered in the discussion.

Experiment No. 2.—Bite-raising metal caps were cemented on both lateral segments (premolars and molars) of an adult, female *Macacus rhesus* monkey. The occlusal surface of these caps was absolutely plane (Fig. 11). In closing the mouth the lower molars and premolars came in contact with the cap, thus raising the bite about five millimeters between the incisors. Models at the beginning of the experiment are shown in Fig. 12*A*. After thirteen months the bite in the front region had closed to two millimeters, and the relation between upper and lower cuspids was that of an Angle Class II. At that time

Fig. 1.

Fig. 3.



the caps were taken off, increased in height, and recemented. Three and one-half months later the caps were permanently removed and photographs, x-rays, and model impressions were taken. (See Fig. 12*B*, 13, 14, and 15). During the experiment the third molars erupted and, since they were not under the influence of the caps, interfered, after removal of the caps, with the complete closure of the mouth. The upper third molars were therefore extracted. After the extraction contact was almost established between the upper and lower molars, and a marked distoclusion could be observed. There were also marked overjet and overbite in the incisal region.

A strengthening of the muscles in contrast to the first experiment, in order possibly to observe the opposite result, could not be chemically attained. Bite-raising caps in the molar region, however, constitute a mechanical means of strengthening muscles because elongation means increased tone. Therefore

this experiment may be contrasted with the first experiment. While in the first experiment masticatory muscles were paralyzed, the same muscles were strengthened in the second experiment.

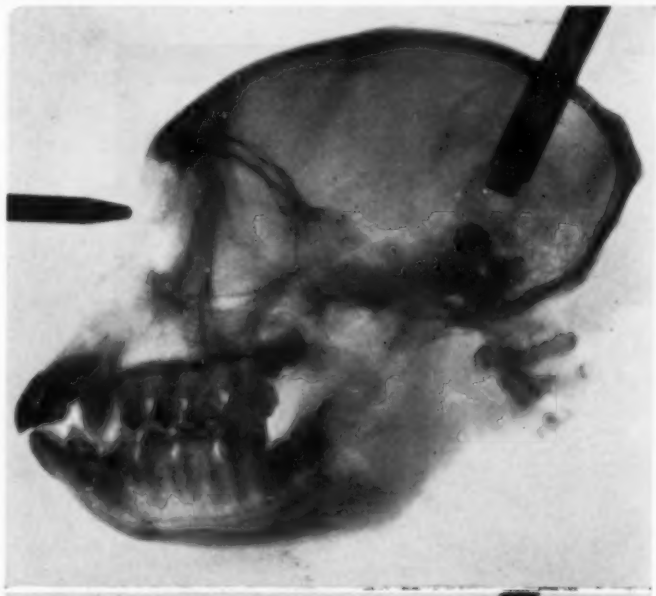


Fig. 2.

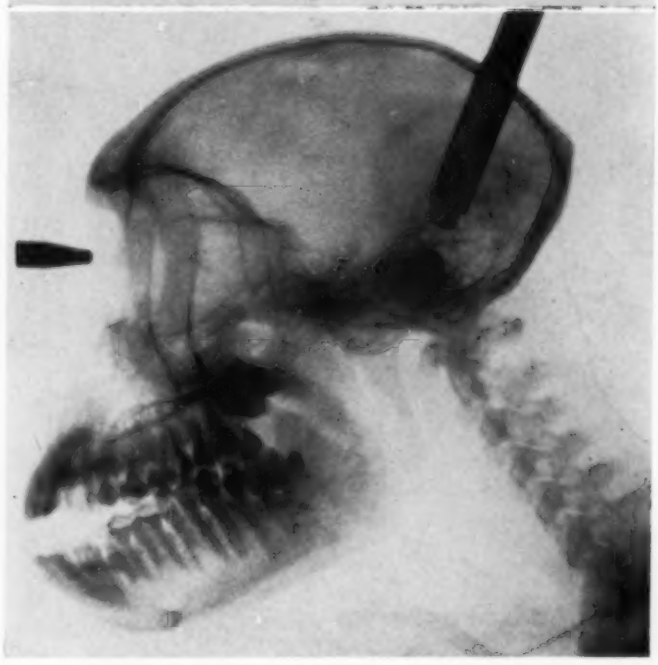


Fig. 4.

Naturally there was remarkable depression of upper and lower molars. That is, in this experiment, the alveolar process was influenced, but this occurred in addition to an extensive distal shifting of the mandible which cannot have taken place within the alveolar bone. This distal shifting of the mandible was encouraged by the flat occlusal surface of the caps, and may be explained in correlation with the other experiment as the result of a strengthening of the masticatory muscles.

The casts made from impressions taken after the removal of the caps show many characteristics of Class II malocclusion in humans. In addition to the malrelation of the lateral teeth we find excessive overjet, excessive overbite, and exaggerated curve of Spee (Fig. 16). The only characteristic frequently

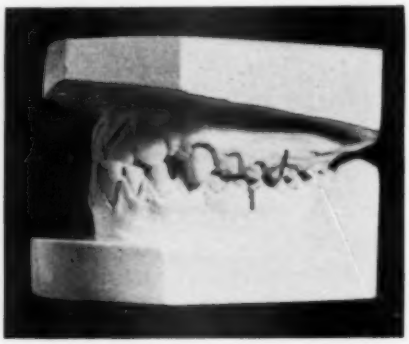


Fig. 5.

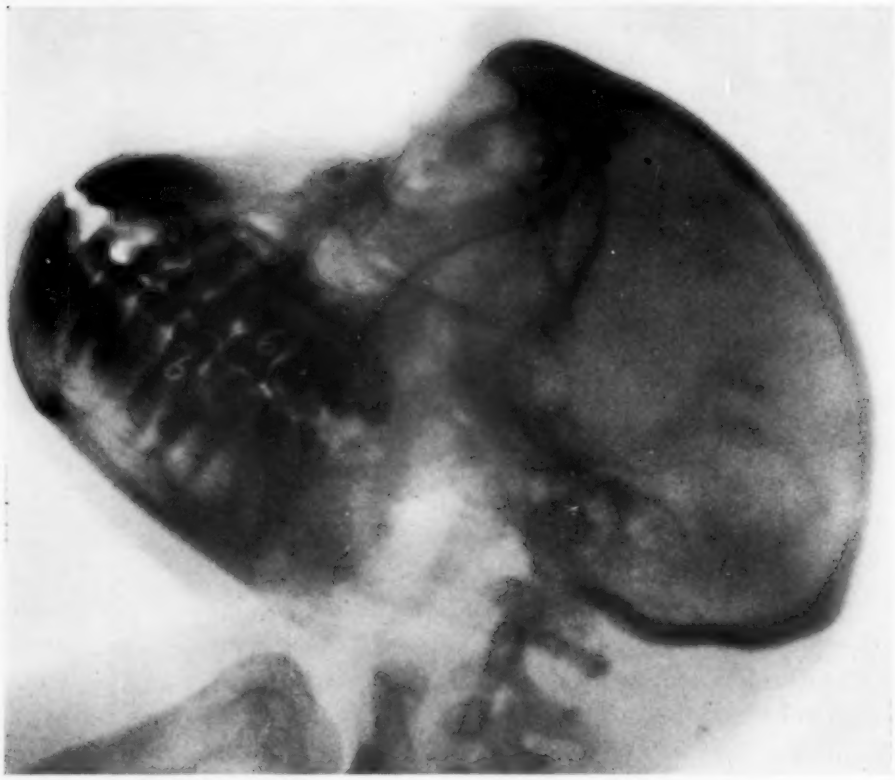


Fig. 6.

observed in humans, and missing in the experiment, is a narrowing of the maxilla. This can probably be explained by the fact that in the experiment the distoclusion developed after the dentition had previously attained normal appearance, that is, at a time when a Class II would never develop in man. It is possible, however, that narrowing of the upper jaw may develop if the distoclusion persists for a period of time.

DISCUSSION OF EXPERIMENTAL RESULTS

We may consider the results of the experiments from three main points of view:

A, as further proof that extra-alveolar bone changes can be induced artificially,

B, as an indication of possible causative factors in the development of dentofacial anomalies,

C, in utilization for therapeutic use.



Fig. 7.



Fig. 8.



Fig. 9.

A. We may take the clinical results of the experiments, in addition to previously published histologic material,[11] as further proof that bone transformations in areas other than the alveolar processes can be induced; for in the first

experiment, at least, the alveolar process (on which no masticatory muscles are attached), has not been affected, and therefore the change of occlusion must have been created through extra-alveolar bone transformations.

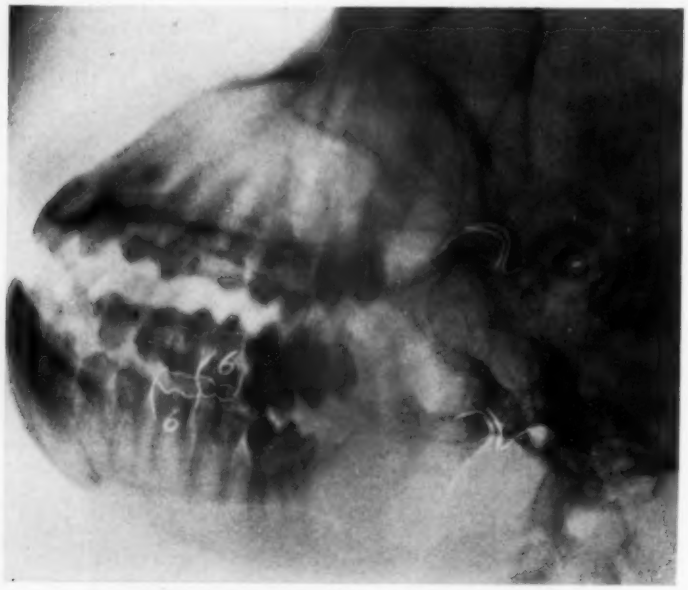


Fig. 10.



Fig. 11.

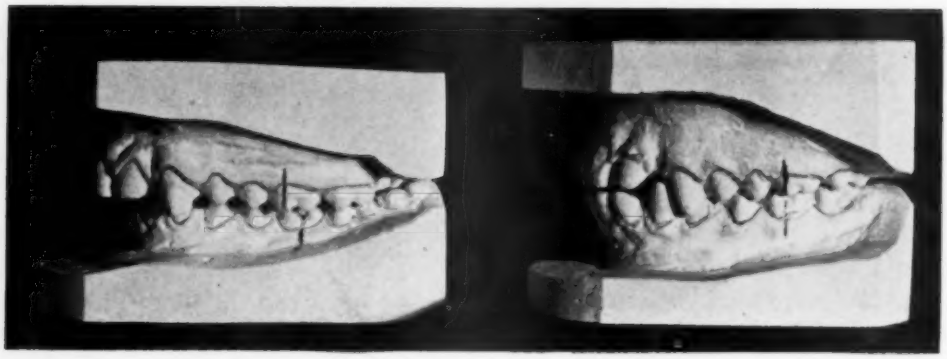
A.  B.

Fig. 12.

B. The results of the experiments may serve as a clue to one possible causative factor in the development of dentofacial anomalies. It seems that proper relation between muscular tension and the resistance of the skeleton is essential to the development and maintenance of normal occlusion, and a misproportion between muscular tension and bony resistance may in some cases be responsible for the development of malocclusions. Overactivity or overtension of masticatory muscles appears to favor the development of a distoclusion of the mandible (Angle Class II) while relative weakness of mus-



Fig. 13.



Fig. 14.

cular function favors the mesial development of the mandible (Angle Class III).*

This theory which is deduced from experimental results is supported by clinical evidence. We know, for example, that most cases of Class II are associated with excessive overjet and deep overbite, or vice versa, while cases of open-bite show a tendency of the mandible to extend mesially beyond normal, sometimes to the degree of a full Class III malocclusion. The manifestations of these abnormalities are so interrelated that it is difficult at times to distinguish between cause and effect. Doubtless, however, there exists a correlation between vertical dimension and mesiodistal relation of the jaws, and there also indubitably exists a correlation between muscular tension and vertical dimension. Therefore it is evident that muscular tension is related to mesiodistal jaw relation.[13]

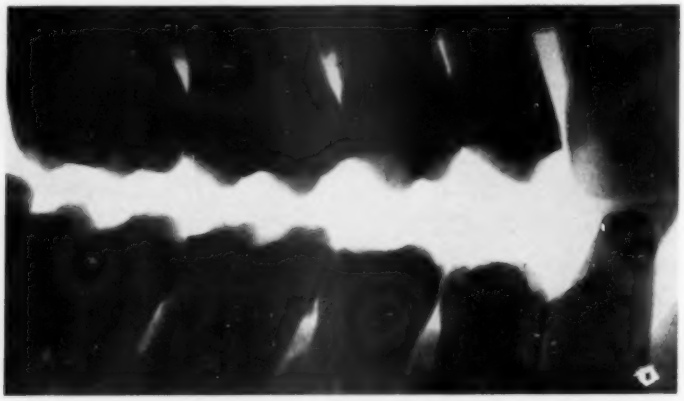


Fig. 15.



Fig. 16.

The muscular tension and the strength of the skeleton are certainly dependent on systemic factors. A search in this direction, therefore, may eventually lead to a better understanding of the causes of dentofacial anomalies.

The number of cases of human dentofacial anomalies which are actually induced by a misproportion of the muscle-bone relationship influencing ver-

*This statement should not be misinterpreted. It holds true only as long as the mechanical arrangement of the masticatory apparatus is not basically changed. Raising the bite in the *molar region* does not change the mechanical arrangement. Forces are altered in intensity but act still in the same areas, and in the same direction as they did before. Raising the bite in the *incisal region* (which has been recommended and is frequently applied for the correction of Class II cases) not only intensifies the muscular pull but also changes the location of the area where the force is applied (incisors instead of molars). The mechanical arrangement is thus completely altered, and the action of the common bite plate cannot therefore be compared to strengthening alone of masticatory muscles.

tical dimension and jaw position is hard to determine. Measurement with a gnathodynamometer of the biting power in a great number of children with normal dentitions, and again of the biting power in a group afflicted with malocclusions may throw some light on this problem. Such measurements are being performed at the orthodontic division of Columbia University, and I am grateful to Dr. Waugh for his cooperation. Results will be published as soon as they can be secured.

The experiments illustrate the modifying influence which the balance of forces acting upon it have on the shape of the masticatory skeleton.

It was emphasized in the introduction that this balance of forces, although an important factor, is but one among the many modifying the inherited growth pattern. Other important factors are the timing and intensity of growth impulses in various regions of the skull, particularly of the jawbones, the development and eruption of the two dentitions, or the disturbance of their normal development by disease, mutilation or both, and certainly many more.

C. Regardless of the number of cases of dentofacial anomalies actually or partially caused by a disproportion of the muscle-bone relationship, the results of the experiments encourage the attempt to influence overbite and jaw position by modifying the muscle-bone relationship in a desired direction, that is, by influencing either muscular tension or bone resistance. Our present knowledge does not permit us to attempt clinically to change bone composition through nutrition or medication, but the modification of muscular tension is already being clinically practiced. Various bite-raising devices, like bite plates, caps, etc., represent an attempt to change muscular action. Raising the bite in any region means preventing masticatory muscles from attaining their normal length and relaxation, while other muscles (the antagonists) are permitted to relax beyond normal. Thus a disharmony of muscular forces acting upon the skeleton is created, which necessarily leads to bone transformations. The location of these bone transformations depends upon the design of the bite-raising device. It is always the teeth and, through them, the alveolar process which are primarily affected, and the resistance of these structures determines whether the muscular balance is re-established through the yielding of the alveolar process, or whether remarkable bone transformations in other areas can be expected. If the alveolar process is rapidly adapted, no noticeable extra-alveolar bone transformations will occur, and vice versa. The design of the bite-raising device can largely influence the resistance of the affected teeth. I want to emphasize again one factor which greatly varies the resistance of the alveolar process to forces applied to the teeth. If stress is brought to bear upon the teeth in a direction of their longitudinal axis, the alveolar bone does not rapidly yield but, on the contrary, is viewed in histologic specimens as densified.[13] If, however, lateral pressure is exerted upon the teeth they will yield rapidly. In other words, in this second case the resistance of the alveolar bone is being overcome, and extra-alveolar bone changes will be more or less negligible.*

*Clinical corroboration may be found in many instances, and particularly in the fact that the so-called oblique plane proves extremely beneficial in cases of Class II, Division 2, where the often lingually-tipped lower incisors hit the so-called oblique plane in reality at a right angle.

The bone transformations induced by disturbances of the balance of muscular forces cease only when the original equilibrium between the forces has been re-established.[11] The time required to attain these bone transformations is in most cases much shorter than the time required safely to attain comparable transformations in the alveolar process through mechanical devices. There must, of course, be means of influencing muscular tension other than bite raising, such as varying systemic factors or locally influencing muscles or nerves through drugs, etc., or by surgical means. Experiments in this direction continue; the investigations have not, as yet, outgrown the experimental stage.

SUMMARY

Current orthodontic literature reiterates the contention that the inherited growth pattern determines the form of the human jaws and that the jawbones therefore cannot be modified or influenced. According to this contention, effective influence of any treatment is restricted to the alveolar bone. (Brodie, Broadbent, Hellman, Thompson, Mershon, Jackson.) The acceptance of this concept limits improvement in orthodontic therapy to the perfecting of mechanical, tooth-moving devices. More important, if the concept is fallacious, it precludes (if accepted) any clarification of the origin of dental and facial malformations. Because of the inherent defeatism of this contention of immutability, any contradictory theory deserves attention.

Generally accepted biologic laws do not support the validity of the theory of immutability of the jawbones (Roux, Darwin, Russel).

Through decades orthodontic research has favored the idea that extra-alveolar areas can be influenced by treatment (Angle, Case, Baker).

Moreover, histologic proof has been published[11] of bone transformations induced in areas other than the alveolar process, such as the temporomandibular joint, ramus, angle and lower border of the mandible.

There remains a contradiction between, on one side, general biology and these findings and, on the other side, the conception of immutability of the jawbones.

The clarification of this issue is fundamental to the understanding of the origin of dentofacial malformations as well as to improvement in the methods of their correction.

In this essay new, clinical proof is added to previously published microscopic evidence that bone changes can be induced in extra-alveolar areas.

In a mature *Macacus rhesus* monkey a complete and lasting change in occlusal relations was created without applying any forces to the teeth or to the alveolar process. No mechanical device was used but, by paralyzing masticatory muscles and thus disturbing the balance between muscular forces and the given resistance of the skeleton, an Angle Class III malocclusion was created in a previously normal animal within seventy-two days. This malocclusion has persisted for one year and a half to date, long after recuperation of the affected muscles.

In a similar animal an Angle Class II malocclusion, with the associated anomalies of excessive overjet and overbite, was created by raising the bite through flat caps in the molar and premolar regions. The development of this Class II may be correlated with the first experiment where a Class III was

created through weakening of the masticatory muscles; for raising the bite means strengthening (increased tone) through elongation of those same masticatory muscles whose weakening induced the Class III anomaly in the first experiment.

The results of the experiments are significant in reference to the following points:

The experiments corroborate previously published histologic evidence of induced *extra-alveolar* bone transformations.

The experiments suggest one possible cause of dental malformations, namely, a disharmony among the muscular forces, or between muscular forces and the architecture of the bone.

The experiments point toward a possible means of influencing the occlusion without employing appliances or similar conventional apparatus, by directly modifying muscular strength or bony resistance, possibly even by influencing systemic factors.

The experiments elucidate the necessity, in attempting improvement of orthodontic therapy, not of concentrating upon mechanical devices but rather of seeking means of modifying the skeleton.

I am grateful to the Diamond Jubilee Fund of the King Solomon Lodge of New York No. 279, F. and A. M. for a grant which has made these investigations possible. I am also indebted to Dean Houghton Holliday and Dr. Leuman M. Waugh of the School of Dental and Oral Surgery of Columbia University for extending to me the facilities of the Orthodontic Division and the Animal Care Department.

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A METHOD FOR IMPROVING FLUX USED IN SOLDERING NONPRECIOUS ALLOYS

JAMES JAY, D.D.S., NEW YORK, N. Y.

In an attempt to overcome some of the difficulties which have been associated with the soldering of nonprecious alloys, a simple addition to the stock solution of flux has been found to produce a definite improvement in its working properties. This method has been suggested to, tried, and found successful by a number of practitioners.

To approximately one ounce of Handy Flux, made by Handy & Harman of New York City, was added twenty drops of Yellow Label Drene Shampoo. This shampoo is one of a large family of so-called "wetting agents." It was chosen because of its general availability and relatively low cost. The amount to add is given only as a general guide and may be increased or decreased within limits. Handy Flux was chosen because of its desirable properties which include a low melting temperature and rapid solvent action. However, the method is applicable to other brands of flux.

The advantages of this improved flux are:

1. All surfaces with which it is in contact remain "clean," or free of oxides.
2. It spreads easily and smoothly.
3. The solder flows more readily.

The following suggestions may aid in obtaining the most from the flux:

1. Maintain the flux at a thin, creamy consistency by the addition of hot water, rather than by the continual addition of "Drene." Keep the container tightly closed when not in use.
2. When soldering, spread the flux in a thin layer for some distance on each side of the solder joint. This helps prevent overheating and cleans the area covered.
3. The residue of the flux should be removed with hot water after the soldering operation.

Wetting agents have many other uses of interest to our profession. They may be used in photographic solutions, for washing hydrocolloid impressions, and to minimize "bubbles" in castings. In fact the limits of their uses lie only within the confines of one's ingenuity or need for such a material.

1 WEST 81ST STREET

Editorial

Orthodontics and Mass Dental Planning

Orthodontics, long considered a "luxury service" in some quarters, has latterly made its appearance in plans for mass dental care. One such plan which calls for "assembly line dentistry" is included in the report of the Pepper Committee on Investigation of Manpower Resources. This plan proposes the reorganization of the present method of practicing dentistry along the following lines:

"1. Complete diagnosis by men comprehensively trained in medicine and dentistry;

"2. A charting of rehabilitation program for every mouth under the supervision of this medical and dental group;

"3. The fractioning of the mechanical procedure by teams of mechanics especially skilled in the given procedure."

As regards orthodontics the plan states the following:

"The system proposed is notably applicable to the difficult field of orthodontia. It would follow that malocclusion, now so frequently not dealt with at all or attempted at too late a stage, would be within the reach of practically everyone. A case that under the present system ordinarily costs from $500 to $2,000, could be corrected, on a mass basis, for from $50 to $100."

Since the foregoing plan is a figment of the imagination of one dentist who, in explaining whom he represents, nevertheless stated, "I might almost claim to speak for organized dentistry," it may possibly be ignored by orthodontic specialists as unimportant. On the other hand, it may well be that the above represents the attitude toward orthodontics on the part of the average dentist. Furthermore, this plan has received wide newspaper publicity and was prominently discussed in *Time* Magazine and elsewhere as a desirable method for providing mass dental care.

With the increase in plans for postwar dental care for the entire population, orthodontists are faced with a dilemma. They can choose to maintain the *status quo* by keeping orthodontics a "luxury service" which reaches less than 200,000 of a possible 5,000,000 children who need it (3 to 4 per cent of the potential demand) or extend the benefits of their specialty by drastically revamping undergraduate orthodontic education and by providing the general dentist with information on preventive measures in orthodontics.

Not unlike dentistry in general the solution of the orthodontic problem, when viewed from a mass angle, lies in prevention and the treatment of incipient conditions. Prophylactic orthodontics must in the future occupy a prominent place in the undergraduate curriculum and should become an integral part of the service rendered by the general practitioner.

The dentist at present regards the child patient as a small-sized adult. He rarely takes into consideration the time element which plays such an important role in dental diagnosis in children. The teeth of the child are examined primarily for cavities, and the establishment of the occlusion is left to shift for itself. Many instances of malocclusion in children could be prevented by simple procedures, as for example, the timely extraction of prolonged retained deciduous teeth and the judicious use of space retainers.

In a field as relatively circumscribed as dentistry is, when compared to medicine, there seems to be no reason why the orthodontic specialist should not confine himself to treatment of manifest malocclusion while much of the preventive work is done by the general practitioner. As matters stand today, more and more dentists are "tackling" orthodontic cases, without adequate postgraduate preparation. It is our belief that no self-respecting dentist with a knowledge of orthodontic principles and preventive measures would wilfully undertake to temporize with the mouths of children.

We orthodontists can, of course, continue to look down from our ivory towers and continue to question the rights of these "interlopers" or show true professional leadership by educating the dentist as to his role in maintaining and establishing the best possible occlusion in the mouth of his child patients.

J. A. Salzmann, D.D.S.



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Max E. Ernst, Secretary, American Association of Orthodontists, 1250 Lowry Medical Arts Bldg., St. Paul, Minn.

Correspondence

Orthodontics in England in Wartime*

Greetings to all Friends, Colleagues, and Members of the New York Society of Orthodontists.

Orthodontics in England is represented chiefly by the British Society for the Study of Orthodontics. Till the outbreak of war, meetings were held six times a year—February, March, May, October, November, and December, but in 1939, after the outbreak of war, the Annual General Meeting only was held and this was for business purposes, though ordinarily it would be combined with a scientific meeting.

In 1940 the following meetings were held:

February: Communication by Harold Chapman: "The Variations and Changes of Normal Occlusion in the Dentition of Children."
Paper by Mr. S. Wilson Charles: "An Introduction to Studies in the Normal and Abnormal Development of the Teeth."

March: Communication by Miss L. M. Clinch: "Serial Models of Normal Occlusion Between Birth and Four Years."
Paper by Dr. Matthew Young and Miss K. C. Smyth: "Post-Normal Occlusion."

May: Demonstration meeting at which the following were shown:

Mr. Harold Chapman:	"Interesting Cases From Practice."
Mr. Wilson Charles:	"Research and Orthodontics."
Miss L. M. Clinch:	"Additions to the Museum."
Mr. N. Gray:	"Oral Photography."
Mr. Russell Marsh:	"Distal Movement of Molars and Premolars."
Mrs. P. Michaelis:	"Serial Models of Treated and Untreated Cases."
Mr. H. C. Visick:	"Some Simple Orthodontic Plates."

September: It will be recalled that the attack on London began: no further meeting was held until December, which was the Annual General Meeting and for business purposes only, when it was decided that ordinary meetings should be suspended.

In 1941 no meetings were held until the Annual General Meeting in December, when, in addition to the business of the Society, ten members gave short communications.

In 1942 three meetings were held as follows:

May: Paper by Mr. A. A. Wilkinson on "The Early Extraction of the First Permanent Molars as the Best Method of Preserving the Dentition as a Whole."

*This letter was received from Dr. Harold Chapman, London, England, in reply to an invitation by Dr. E. Santley Butler for a written account of the status of orthodontics in England to be read at the annual meeting of the New York Society of Orthodontists.—J. A. Salzmann, Editor, New York Society of Orthodontists.

In considering this paper, the Discussion should be read at the same time, from which it will be observed that there was not general agreement with Mr. Wilkinson's findings, which in my opinion, were not supported by satisfactory evidence.

September: Paper by Sir Frank Colyer: "Labour and Dental Deformities."

December: The Annual General Meeting was held, when in addition to the business, a paper was read by Mr. O. Henry: "A Modernised Expansion Plate Worn at Nights Only."

In 1940, 1941, and 1942 no subscription was levied but for 1943 the subscription has been reimposed.

The British Society for the Study of Orthodontics has appointed a Committee to consider the following:

1. To report on and to make proposals for the undergraduate teaching of orthodontics.

2. To report on and to make proposals for the postgraduate teaching of orthodontics.

3. To report on and to make proposals for research in orthodontics.

4. To report on and to make proposals for the orthodontic treatment of children in public elementary schools.

The Committee hopes to present its report to the Council on the first of these subjects in the near future.

The Treasurer of the Society, Mr. H. R. Evans, joined the Forces, and I succeeded him in February, 1940.

It may be known to you that there is a school dental service covering the greater part of England. There is an increasing tendency for orthodontic treatment to be included in this work and, as far as I am able to judge, there is no diminution of this tendency. The London County Council employed two part-time orthodontists prior to the war but up to the end of 1942 it employed only one, who did five sessions a week in comparison with the six sessions done by the two previously. Since January 1, 1943, the pre-war arrangement has been re-instituted, that is to say, two orthodontists working three sessions a week, a session being a half-day. I have been able to confirm in the case of only one of these that she is working the same amount of time as pre-war. One of these orthodontists specialises, the other I am doubtful if that is so, but both are employed to do orthodontics only. No other public authority employs a dental office to do only this work.

The President of the Odontological Section of the Royal Society of Medicine, Mr. B. Maxwell Stephens, gave a Presidential Address entitled: "Some Aspects of Inferior Protrusion and the Advisability of Early Treatment" in October, 1942, and in February, 1943, I gave an address at Southampton to the Southampton District Section of the Southern Counties Branch of the British Dental Association. The latter was only a small meeting but these facts show that an interest in orthodontics is not neglected. An "alert" sounded a few minutes after I had begun to speak!

The main body of the British Dental Association functions only for business purposes, though individual branches and sections of branches hold meetings of general dental interest, political as well as scientific, at intervals. The Odontological Section of the Royal Society of Medicine is the only dental society, as far as I am aware, which has continued to function unchanged as regards the number of its scientific meetings.

Whilst just prior to the war and during the first twelve to twenty-four months orthodontic practice was, in my experience, very much less than it had been in 1942, it recovered very considerably so as to be equal to what it had been for several years prior to 1939.

HAROLD CHAPMAN.

Department of Orthodontic Abstracts and Reviews

Edited by

Dr. J. A. Salzmann, New York City

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Bone Development in Preschool Children: By Charles L. Wilbar, Jr., M.D., Honolulu, T. H., *J. Pediatrics* **21**: 504-509, October, 1942.

For ten years, a health project at Ewa, Hawaii, was occupied with studying the effect of diet upon tooth decay and upon the general health of preschool children living in the village owned by the Ewa Plantation Company. During this time, the average population on this sugar plantation was approximately 4,000, with a mean of ninety-nine births per year.

This paper deals with the findings of the roentgenograms of the wrists and ankles of these children and the relationship of dietary factors to these findings.

Compared with the table for Range of Appearance of Osseous Centers of Extremities prepared by the Harvard School of Public Health (range of middle 50 per cent), seventy-two out of the 182 Ewa children showed a retardation beyond normal limits of the appearance of their osseous centers at some time during the three-year study, and none of them had an accelerated rate of development.

Using a modification of the diet analysis developed by Burke and Stuart at the Harvard School of Public Health, a determination was made of the diet of the Ewa children included in this study. The changes from the original method of diet analysis consisted of including Hawaiian foods and cross-questioning the mothers more thoroughly about details of their children's diets, using a sample set of standard household measures and sample blocks of wood of known volume to check against the volumetric judgment of the mothers. Quantitative determinations were made of the intake of the various food elements in each child's diet.

Calcium, phosphorus, vitamin D, and vitamin A have been named by various authors as concerned in osseous development. The vitamin D intake of the Ewa children could not be ascertained with any degree of accuracy because of their heavy exposure to sunshine. The work of Venar and Todd would indicate that this vitamin is not such an important factor in determining the extent and density of mineralization of growing bone as was believed. Since there is an average of only about twenty inches of rain per year at Ewa, with better than seven and one-half hours of sunshine per day on the average, and the climate

is conducive to having children play out of doors during all of the year (which they do), there would seem to be little doubt that the Ewa children receive optimum amounts of vitamin D. Further indication of adequate vitamin D in these children is the paucity of evidence of rickets in the x-rays of these children and complete absence of clinical evidence of rickets. Fifteen of the 182 showed questionable x-ray signs indicative of mild rickets. Two of the Nanakuli group and one of the Waialua group showed similar signs.

Of the seventy-two children in the group studied at Ewa who showed retarded osseous development by comparison with the table developed by the Harvard School of Public Health, satisfactorily accurate dietary histories were obtained in fifty-nine cases. The remaining histories were omitted from statistical analyses because of insufficient cooperation or ignorance on the part of the parents, change of residence before completion of the history, sickness, etc.

This investigation discovered preschool children with retarded bone development compared to a table of "normal" based on broad bands. The retardation was present in spite of an adequate intake of the food factors believed to be necessary for proper bone development, according to generally accepted dietary standards. These findings would tend to throw suspicion on one of the two sets of "normal" standards, either the standard concerned with food elements or that concerned with osseous development.

Although much research has been done in the field of nutritional standards in recent years, these standards are yearly being changed by leading authorities. The rapid metabolic rate of the preschool child, with its many marked individual variations among children in good health, makes minimum standards for nutritional elements in this period difficult of determination and requires many more observations than are yet available.

This study would tend to indicate one of three conclusions: (1) There is an as yet unrecognized racial or hereditary factor which has to do with bone development; or (2) standards of adequate intake of calcium, phosphorus, vitamin A and/or vitamin D should be raised; or (3) retarded osseous development is an exceptionally fine indicator of inadequacies in diet.

Obesity in Children: By I. P. Bronstein, M.D., L. J. Halpern, M.D., and A. W. Brown, Ph.D., Chicago, Ill., *J. Pediatrics* **21**: 485-495, October, 1942.

Obesity in childhood is the most common so-called endocrinopathy encountered in pediatric practice. The prevalent assumption that obesity is usually an expression of some underlying endocrine dysfunction has led to the indiscriminate, if not harmful, administration of various endocrine products in the hope of curing this disorder. Recent excellent work has, however, emphasized the fallacy of such an assumption, and the suggestion has also been made that the term Fröhlich's syndrome, to designate markedly overweight children, be deleted from the nomenclature.

This investigation comprised a complete initial history and physical and laboratory examinations of each child on admission and at regular intervals thereafter until the last visit. The history included information on each child's type of delivery, birth weight, and condition at birth, the onset of obesity to-

gether with any suspected relationship to some illness, accident, or surgical measure, the type and quantity of food as well as the amount of fluids consumed daily, whether the appetite was voracious, moderate, or poor, whether a child was lazy or active, and the incidence of obesity or any endocrine disorder in other members of the family as well as their inclination toward short or tall stature.

The physical examination included general and regional observations with special emphasis on the amount and per cent of overweight; height attainment of each child compared with reliable standards; the distribution of fat, shape of the hands, sexual development, and the status of the ocular fundi and visual fields.

The average age of the entire forty-six children on admission was 10 years and 11 months. The average weight of the entire group on admission was 134¾ pounds, or 57 per cent overweight. The twenty-eight males were 55 per cent overweight compared to 59 per cent in the eighteen females. Eight of the forty-six children were more than 80 per cent overweight, three of which were 104 per cent, 108 per cent, and 128 per cent overweight, respectively. The average height attainment of the entire group on admission was fifty-seven inches compared to sixty inches, which is the average tall limit, and forty-seven inches, which is the average short limit for children of similar average ages.

Throughout this study and at its conclusion, the authors were unable to find evidence of a single case of endocrine dysfunction in any of the forty-six obese children. However, it cannot be overemphasized that obese children should be thoroughly studied in order to detect the occasional instance where a pathologic disturbance may underlie the adiposity.

Cephalometric roentgenographic analysis of the craniofacial skeleton showed that in general the development in this group of children is normal and even slightly in advance of normal controls. Tooth eruption was accelerated, whereas in hypopituitarism and hypothyroidism it is retarded.

The treatment for obesity consisted mainly of restricting the diet and fluid intake, exercise, and adding ample vitamins. When the child adhered to this regime, a moderate loss of weight followed in most instances, but the majority refused to cooperate from the beginning or after a relatively brief interval.

Oral administration of thyroid extract in large daily doses over fairly long intervals did not cause loss of weight in most instances. Chorionic gonadotropins or whole anterior pituitary extract given parenterally in even large doses failed to influence the weight. Amphetamine sulfate, while immediately effective in causing a reduction of weight by depressing the appetite, lost its effect soon after the drug was stopped, and in some instances even while the drug was being taken.

From the foregoing it is apparent that no appreciable loss of weight was effected in these patients regardless of the type of treatment used. Obesity in mentally adequate children tends to correct itself at or about puberty, at which time they become cognizant of their obesity as a handicap and are then willing to cooperate satisfactorily in a dietary regime.

Anthropometry in the Pediatrician's Office. (Norms for Selected Body Measurements Based on Studies of Children of North European Stock): By Vernette S. Vickers and Harold C. Stuart, M.D., Boston, Mass., *J. Pediatrics* **22**: 155, February, 1943.

There have been many intensive studies of the growth of children in this country in recent years. Much valuable information has thus been assembled, both as to the normal distributions of measurements obtained from groups of children at succeeding ages and as to the rate of growth in various dimensions at each age. These studies have shown that while a wide range of difference exists between children of the same age, individuals tend to remain in much the same position with respect to the normal distribution from period to period and tend to grow in an orderly and predictable manner at succeeding ages. It has also been shown that not only racial, but also economic, dietary, and other factors influence the size of children in different groups. There is considerable reason to believe that nutrition in childhood cannot be adequately assessed without taking into account retardations in growth which may take place without accompanying signs of deficiency disease or without laboratory evidences of depletion, at least at the time of study.

The children upon whom these measurements were obtained were principally of Northern European stock (a large proportion Irish), and the majority of the children of the group were brought up in the vicinity of Boston in homes of low to middle economic circumstances. Their parents, however, did have the advantage of periodic health and nutritional advice. For further details as to the conditions under which these measurements were obtained, the reader is referred to an earlier publication.

Norms for certain body measurements have been selected which appeal to us as likely to be useful to pediatricians for the purposes outlined above. (The medians and certain other percentiles, the extremes of the series, and the means and sigmas for these measurements at succeeding ages from birth to 10 years are presented in tables.)

Body weight will, of course, be included in any list because it sums up the results of all increments in size and is already established and familiar to both parents and physicians.

A length measurement would seem the next choice, and total length is preferable to any segmental length. Figures for standing height and recumbent length are given, but whenever possible the latter should be used, as it gives more consistent results. In general, recumbent measures are preferable to erect measures because postural alterations are eliminated.

At least one breadth dimension should be taken, and preferably both the chest and the pelvis will be measured. The breadth of the pelvis usually reflects quite well the general stockiness of the child, but often recumbent chest breadth or chest circumference affords useful supplementary information. Measurements of the chest taken in the erect position are especially unreliable. Of the two pelvic breadth measurements presented, the bi-cristal taken with spreading calipers is suggested for use in the early years, whereas either is

satisfactory thereafter. The sliding arm calipers may be used in infancy and in the recumbent position but will give values about 5 mm. greater than those presented under bi-cristal recumbent, taken with the spreading calipers.

Head circumference is a useful measurement to follow during infancy but rapidly loses value as the growth of the head decelerates during early childhood.

The data on crown-rump length and sitting height are presented, as these measurements are of interest on children of exceptional size or build, but their routine use with all children is hardly justified.

In addition to the norms for actual measurements, increments in weight and height for fixed age intervals are presented. These are average increments, or more correctly, the differences between the means at consecutive ages, and they do not portray the range of the distributions for the group. It is, however, convenient to have an average figure to which to refer when trying to decide whether or not a given gain should be considered adequate for a child of any particular sex and age.

It is suggested that the pediatrician consider each measurement as obtained, first, in respect to its position in the "normal distribution" for sex and age, as revealed by the tables; second, in respect to the positions of other measurements within their distributions; and third, in relation to the position of this measurement at the last examination. For example, if a boy's weight is close to the twenty-fifth percentile for his age, while his height is above the fifty percentile, it is not necessary to know expected weight for height to know that he is either narrow in build or lacking in some tissue. If his pelvic breadth also falls near the twenty-fifth percentile, the former explanation seems probable. However, the pediatrician will do well to take the evidence from the measurements (related to the norms) as suggestive of the individual's characteristics and will attempt to interpret them only after careful inspection of the child and study of his body configuration and the amounts and characteristics of his various tissues. He should then give special consideration to any changes which have taken place in the percentile ranks of the various measurements during the period since the last examination.

The techniques used in obtaining these norms are defined in the following section, together with a description of the measuring instruments used. The former are not difficult to carry out and the latter may be secured at little cost.

For measurements to serve any useful purpose, especially when the progress of growth is to be taken into account, they must be taken when the child is reasonably relaxed and cooperative, and with care as to the details of position, landmarks, use of instruments, and reading of scales. The added time required to check each measurement after changing and re-establishing position is thoroughly justified. The habit should be formed of applying all instruments with uniform, moderate pressure.

APPARATUS REQUIRED FOR SECURING MEASUREMENTS PRESENTED

Scales.—Two types of balance scales are used: one the basket variety for infants, the other a standing scales for children.

Examining Table Anthropometer.—The same table may be used for taking all recumbent measurements, as well as for the pediatric examination. Most examining tables can be converted into a suitable measuring table at little expense. The required features are:

1. A firm, preferably hardwood, surface or not more than a thin pad for comfort.

2. An upright board, about five inches high at one end of the table, which serves as the zero of length measurements. From the top of this an extension projects at right angles, necessary only for crown rump (stem length) measurements. This should be about sixteen inches long but need not be the full width of the table.

3. A movable board (of the same size as the upright) which slides on the table at right angles to its sides and is brought against the child's head.

4. A scale, preferably a two-meter stick carrying both metric and English markings to one-eighth inch, set into the table top along the edge nearest to the examiner, with zero at the fixed upright end.

Upright Measuring Device.—This consists fundamentally of a box, preferably ten inches from the floor, ten inches deep from the wall, and sixteen inches broad, upon which a child can stand for height measurement and upon which he sits for sitting height measurement. The box should be attached or fit flatly against the wall, its top just at the zero mark of a two-meter stick mounted on the wall. A wooden triangle with broad base may be used against the latter and brought down on the head. Several companies make a stadiometer* which is a movable unit supporting the meter stick and sliding right angle head piece.

Tape.—Cloth tapes are more convenient than steel for measuring circumferences on young children but should be checked frequently against a rigid standard and discarded if stretch or shrinking has introduced an appreciable error.

Spreading Calipers.—A small sized standard obstetric caliper, the points of which are pressed gently against the soft tissues over the landmarks delimiting the breadth measurement.

Sliding Calipers.†—These are usually made of wood with a fixed right angle arm at the zero end of a metric scale and a sliding arm of equal length.

DEFINITIONS AND STANDARD TECHNIQUES‡

Body Weight.—Weight is measured in pounds and ounces on the infants' scale and in pounds and quarter pounds on the children's scale. The infant scale is used through the two-year examination.

Total Length.—Length is taken in the recumbent position. The soles of the feet are held firmly against the fixed upright and the movable square is brought firmly against the vertex. The chin is held so that the eyes look directly at the ceiling. Less resistance is offered by young children if the feet are held against the fixed upright instead of the head.

Standing Height or Stature.—The child stands with his heels, buttocks, and shoulders against the vertical upright, unless insistence upon contact of all these points causes a change from natural posture. The eyes are parallel with the floor. The movable square is pressed firmly upon the head.

Crown-Rump or Stem Length.—This measurement is made with the head and trunk in the dorsal recumbent position and the buttocks held firmly against a fixed right angle upright. The hips and knees are flexed to right angles, and the head is held in the same position as for the total length measurement.

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*Stadiometers may be purchased from the Narragansett Machine Co., Providence, R. I., and from C. H. Stoelting Co., 424 No. Homan Ave., Chicago, Ill.

†Sliding calipers may be purchased from Stanford University, San Francisco, Calif.

‡All measurements used were taken without clothing other than a tight pair of shorts after the child was 6 years of age. With few exceptions, the procedures adopted conformed to those prescribed by the International Agreements. Measurements included in the distributions for any age were taken within a specified number of days of that age, the deviation allowed increasing with age from ± five days at 3 months to ± four weeks at 10 years. Prematurely born infants and defective or chronically ill children were excluded from this series. For further details as to the conditions under which the norms were obtained, reference may be made to earlier publications.

Sitting Height.—The child sits on a horizontal seat with his sacral and scapular regions touching the vertical rule. The feet rest upon the floor and the eyes are parallel with the floor. The height is read to the vertex as in standing height.

Head Circumference.—This measurement is more satisfactory if taken recumbent. The tape passes over the most prominent part of the occiput and just above the supraorbital ridges.

Chest Circumference.—This measurement is more satisfactory in the recumbent position, as it is less influenced by posture. The reading is made at midrespiration, the tape encircling the chest at the level of the base of the xiphoid process of the sternum.

Chest Breadth.—This measurement is taken in the horizontal plane at the level of the base of the xiphoid process of the sternum, in the recumbent position, with the spreading calipers. The reading is made at midrespiration.

Pelvic (Bi-cristal) Breadth—Recumbent.—This measurement is the maximum distance between the external margin of the iliac crests, *using spreading calipers.*

Pelvic (Bi-cristal) Breadth—Erect.—This measurement is the same as the above except that the subject is erect, and *sliding calipers are used.* This measurement will be about 5 mm. larger than intercristal-recumbent diameter.

News and Notes

Central Section, Pacific Coast Society of Orthodontists

The Central Section of the Pacific Coast Society of Orthodontists met at the Hotel Claremont, Berkeley, Calif., Feb. 22, 1943.

Our first essayist was Dr. George Chuck of Long Beach, who gave an illustrated talk on "Analysis and Treatment of Cases." Dr. Willard Fleming, Dean of the University of California, gave an interesting talk on "Dental Colleges and the War," in which he humorously told of the trials and tribulations of a dean in these troubled times. Past-President Wm. Dinham, then read a letter to the directors of the P.C.S.O. which accompanied the resolution granting Honorary Membership in the Society to Dr. Fleming, to whom an appropriate pin was then presented.

Mr. E. S. Shulters, Technical Assistant to the Director of the Pacific Coast Office of the U. S. Maritime Commission, spoke on "The War and the Merchant Marine." He brought out many interesting and unknown facts and later answered numerous questions asked by the members. Dr. Fred West addressed the meeting on the subject of "The Dentists and Civilian Defense," and included in detail the part played by San Francisco dentists in the degassing service. Dr. Wm. Dinham, of Portland, Ore., gave an illustrated paper on double protrusions which was followed by slides on double protrusion treatment by Dr. Milton Fisher of Tacoma, Wash.

Dr. George Hahn, President-Elect of the California State Dental Association, gave a brief report on the requirements of the Army and Navy for dentists in 1943. Because of the removal of many dentists from civilian practice and the growing demand for service, he suggested that each orthodontist devote one day per week to children's dentistry. A committee was appointed by Chairman Smith, consisting of Drs. Dean, Stryker, Setzer, and the Chairman and Secretary of the Central Section, to study this important matter.

Dr. Donald McEwan of Seattle, Wash., gave an illustrated lecture on "Case Analysis and Treatment." This was followed by a period of table clinics and "gadgets" and those taking part were: Dr. George Chuck, follow-up of lecture; Dr. Will Sheffer, photography and a buccal sheath press; Dr. Don McEwan, treatment casts; Dr. E. Johnson, headgears; Dr. Earl Lussier, case report with patient; Dr. Ray McClinton, chrome alloy attachments and bracket-holding pliers; Dr. C. Konigsberg, making coil springs and photographic equipment; Dr. Leland Carter, adjustable plate retainer; Dr. Reuben Blake, cement powder funnel and headband magnifier; Dr. John E. Richmond, Eugene, Ore., new method of constructing and inserting lingual arch.

At the conclusion of the evening banquet, Dr. Ben Reese read his president's address and installed the new officers for the coming term. Dr. Don J. Aubertine of San Francisco, who is connected with the University of Mexico, then gave a talk on "Our Latin-American American Neighbors" and showed beautiful colored movies of Mexico.

Southwestern Society of Orthodontists

The twenty-third annual meeting of the Society was held at Tulsa, Okla., March 23 to 25 with an attendance of eighty members and guests.

The program, as previously published, was presented and was well received. At the opening session, a Service Flag displaying stars to represent the fourteen members of the Society who are now in Service in the Dental Corps was presented with appropriate and explanatory comments by Dr. H. B. Harper. Additional stars and names will be added as other members are called into Service.

In addition to some twenty table clinics and case reports, five papers were presented by Drs. W. B. Stevenson, W. J. Bryan, Arch B. Brusse, Thos. E. Purcell, and P. G. Spencer

with prepared discussions by Drs. Scott P. Bowyer, H. B. Robison, W. E. Flesher, F. M. Calmes, and Harry Allshouse.

A high light of the meeting was a joint banquet, Wednesday evening, with the Tulsa Dental Society with nearly 200 in attendance. Dr. E. W. Wise, Tulsa, served efficiently as Toastmaster and Dr. Thos. E. Purcell, Dean of St. Louis University School of Dentistry, presented a paper on the "Trends of Dental Education."

Thursday morning was devoted to a general consideration of the following topics under the direction of Dr. T. W. Sorrels: "Licensure of Dental Specialists," "Problem of School Attendance and Dental Services," "Financial Problems in Orthodontic Practice," "The Effect of War on the Economic Phase of Orthodontics." Prepared discussions were presented by Drs. Leo Shanley, John Richmond, W. Wayne White, L. P. Winston. General discussion followed.

While present conditions greatly curtailed attendance, it was encouraging to note the evident interest of those in attendance, and the universal desire to carry on for the duration, since the annual meeting of the parent organization, The American Association of Orthodontists, has been postponed for 1943. The Society was exceedingly pleased and gratified to have as guests the President and Pres.-Elect, of the American Association of Orthodontists; namely, Dr. J. A. Burrill, Chicago, and Dr. Arch B. Brusse, Denver. Dr. Burrill outlined the present status and future plans of the Association regarding the possibilities of its next annual meeting.

Several applications for membership were received and the applicants were unanimously accepted into the Society. Pres. E. Forris Woodring and the local committees are to be commended for the excellent manner in which the meeting was handled.

The new officers elected and installed for next year were as follows: President, Dr. Hamilton D. Harper, Shreveport; Pres.-Elect, Dr. Harry Sorrels, Oklahoma City; Vice-Pres., Dr. Brooks Bell, Dallas; Sec.-Treas., Dr. J. O. Bailey, Wichita Falls; Chairman Board of Censors, Dr. J. B. McGinnis, Beaumont; Director, American Association of Orthodontists, Dr. W. T. Chapman, El Paso; Alternate, Dr. T. W. Sorrels, Oklahoma City.

Dr. R. E. Olson, who has served so efficiently as Secretary-Treasurer for the past five years, was elected a member of the Board of Censors. Shreveport, La., was unanimously selected, upon the invitation of Dr. Curtis Williams, as the host city for the next annual meeting.

State Quotas for Dentists for Armed Forces

The Chairman of the American Dental Association War Service Committee, Dr. C. Willard Camalier, has issued the following release to various state chairmen, pertaining to state quotas for dentists needed in the Armed Forces:

The following release to State Chairmen for Dentists in States having quotas for 1943, dated April 8, 1943, regarding change in age limit of dentists eligible for commissions, has been issued by the Directing Board of the Procurement and Assignment Service:

> It has been obvious for some time that it will be difficult to fill State quotas for dentists within the upper age limit of the 39th birthday. The Officer Procurement Service is announcing to their district offices that this limit has been increased to 42. However, their willingness to do this was dependent upon assurance from Procurement and Assignment Service that each State Chairman would submit the names in chronological order, that is, all available dentists age 38 and under until the supply is exhausted, then all available dentists age 39 until the supply is exhausted, and then those age 40 and 41 in turn. Their hope is, of course, to fill the ranks with those under 40 if possible.
>
> Your cooperation in this plan will be greatly appreciated since it is essential to the revisions in the upper age limit set by the Office of the Surgeon General.
>
> The Officer Procurement Service is also notifying their district offices that commissions will be extended to dentists between the ages of 42 and 44, inclusive, who are classified 1-A by their local draft boards, provided the reclassification was not at the request of the dentist but was a routine classification by the local board.

Charles Virgil Mosby Memorial Exhibit, Tulsa, Oklahoma, March 23-25, 1943

Due to the fact that the late Dr. C. V. Mosby had, for many years, aided the Southwestern Society of Orthodontists in securing prominent essayists for their programs the Society, at the suggestion of Dr. Brooks Bell, arranged and presented an exhibit in memory of Dr. Mosby at their recent meeting in Tulsa, Oklahoma.

A suitable table was placed in the main assembly hall upon which were placed many copies of early editions of the JOURNAL in addition to a large framed photograph of the late Dr. Mosby. A resolution of appreciation was read and placed in the minutes.

The entire membership of the Southwestern Society is fully aware that due to the personal efforts of Dr. Mosby the specialty of orthodontics has at this time a very comprehensive printed record of the progress of orthodontics for a period of over thirty years. No other specialty in dentistry has such a record and few specialties in the medical profession have a more complete record of their achievements.

Dr. Mosby sincerely believed that there is great merit in the practice of orthodontics. He evaluated its benefits and future possibilities equally as much as any practitioner of the specialty. To this belief he contributed much of his time, effort, and money.

It has been said that "we progress by recognition of our mistakes." Dr. Mosby believed that if we recorded them, together with our improvements, we would the better remember them and profit thereby. The dental and medical professions owe much, which they can never repay, to the life-long effort of Dr. Mosby to provide, record, and preserve the progress of their professions.

Dr. Mosby was often a welcome visitor at many past meetings of the Southwestern Society. Among the membership he held many close personal friendships. The specialty of orthodontics and his many friends in the Southwestern feel a personal loss and sincerely regret that he has passed from among us.

Committee:
HAMILTON HARPER
BROOKS BELL
PAUL G. SPENCER

"Dental Pictorial"—New A. D. A. Publication

The preventive dentistry program of the American Dental Association is to receive a new impetus with publication by the Association of *Dental Pictorial*, a bimonthly illustrated publication—first of its kind—which tells the story of dental health in lay language.

Through the cooperation of practicing dentists and others in the field, *Dental Pictorial* is expected to reach many thousands of American homes, as well as teachers, health officials, and libraries.

Edited by Dr. Lon W. Morrey, director of the Bureau of Public Relations of the American Dental Association, *Dental Pictorial* will be profusely illustrated and printed in color, and it will present a constant stream of new and diversified dental educational material. It will carry no advertising.

In announcing the publication, Dr. Morrey declared:

"The publication is the result of many years of planning with the cooperation of health authorities and educators. It will provide teaching materials for use in classroom work and at the same time be an entertaining readable magazine for the home.

"It is hoped that *Dental Pictorial* will help remedy a condition which affects at least 90 per cent of our school children, a condition so dramatically demonstrated by the high percentage of young men rejected by the Armed Forces because of dental disease."

The subscription price of *Dental Pictorial* has been fixed at $1.00 for two years, in the aim of obtaining a wide circulation. Inquiries may be directed to *Dental Pictorial*, American Dental Association, 222 E. Superior St., Chicago, Ill.

Denver Summer Seminar Cancelled

The Board of Directors of the Denver Summer Seminar announces that the seminar for the year 1943 has been cancelled because of transportation difficulties and other wartime restrictions.

GEORGE S. SIERSMA, Secretary

Prize Essay Contest Postponed

The Research Committee of the American Association of Orthodontists announces the postponement of the Prize Essay Contest until the next meeting is called by the Association.

In order that those contestants who have already submitted manuscripts may not be discriminated against through this action, and also to make their studies available to the rest of the profession, their manuscripts are being returned to them with full authority for publication, wherever they may place them. A list of such manuscripts is being held in the office of the chairman, and the manuscripts or reprints thereof will be called for at the time of the judging.

The deadline for submission of manuscripts has been postponed indefinitely and new manuscripts may be submitted for consideration at any time until further notice. All manuscripts will be judged at the same time.

Note of Interest

Dr. H. Lincoln Dunn has announced that he has succeeded Dr. A. LeRoy Johnson in the practice of orthodontics at 11 East 68th Street, New York, N. Y.

To Our Readers

The exigencies of the war situation have made it necessary to comply with the order of the War Production Board to reduce the weight of paper previously used for the JOURNAL. While this change will not affect the printed page it will affect the quality of the halftone illustrations. We regret that we have no choice in the matter and would ask the forbearance of our readers. As soon as the restrictions are removed, we shall resume our practice of printing the JOURNAL on the previously employed heavier grade of paper.

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*The Journal will make changes or additions to the above list when notified by the secretary-treasurer of the various societies. In the event societies desire more complete publication of the names of officers, this will be done upon receipt of the names from the secretary-treasurer.

†The Journal will publish the names of the president and secretary-treasurer of foreign orthodontic societies if the information is sent direct to the editor, 8022 Forsythe, St. Louis, Mo., U. S. A.

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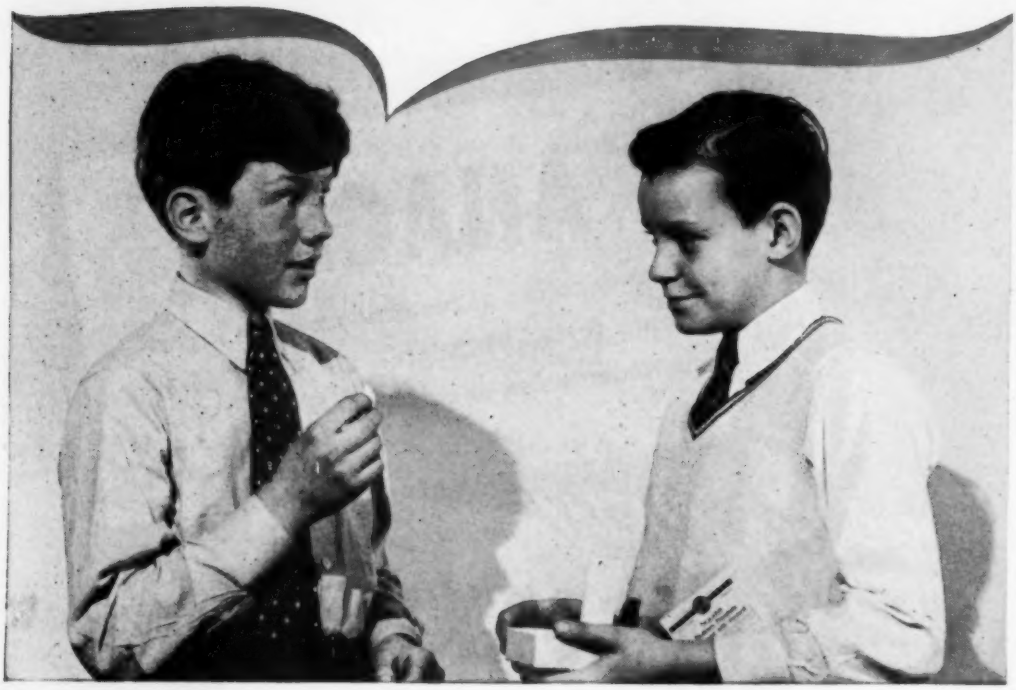
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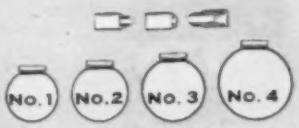
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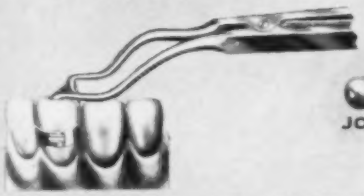
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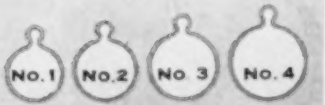


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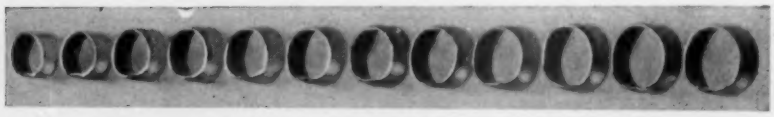
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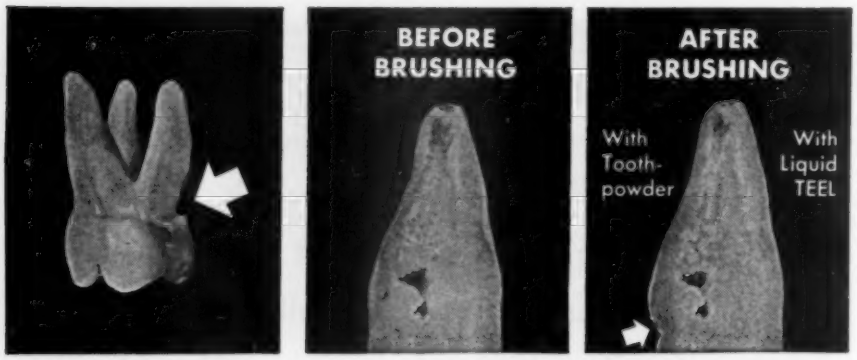
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GROOVES LIKE THIS

(In cementum and dentin exposed by gingival recession)



CERVICAL GROOVE ABRADED IN VIVO
Showing damage done by tooth-pastes and powders.

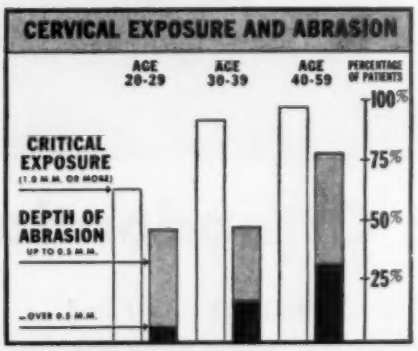
HOW GROOVES ARE MADE
After 86,400 strokes, left side of tooth brushed with tooth-powder, was deeply abraded. Right side, brushed with non-abrasive liquid TEEL, was unharmed.

NEW TEEL TECHNIQUE

Avoids Brushed-In Grooves—and Overcomes "Stains", too

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Such grooves are extremely common. Clinical studies indicate 6 in 10 patients may have them.



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These grooves—readily distinguished from acid erosions—are clean-cut cervical notches—polished smooth by brushing. *They are gradually ground into teeth by the abrasives used in leading toothpastes and powders* . . . as shown by clinical studies and laboratory tests.

8 IN 10 TOOK RISK

The findings of these tests* may be summarized as follows:

First, **58% of all adults examined had these grooves in softer calcified parts of teeth (exposed by receding gingivae)**

**Jrnl. of Dental Research, 20 565-95, Dec. '41.*

cavities ground-in by abrasives contained in toothpastes and powders they regularly used. *Second,* **the deepest ground-in cavities were found in teeth cleaned most regularly.** *Third,* **8 in 10 had sufficient gingival recession to run this risk constantly.**

But notice, doctor—TEEL cannot cause these grooves. Abrasives are to blame . . . and TEEL contains *no abrasives.* In fact, TEEL is the *only* leading dentifrice to clean without abrasives. It is safe . . . even for patients with excessive gingival recession.

TEEL METHOD REMOVES "STAIN" *SAFELY*

TEEL possesses excellent cleaning characteristics... is refreshing to the taste, too. TEEL, in conjunction with the toothbrush, readily removes the common film of materia alba and mucin plaques, and ordinary surface discoloration.

The new TEEL Technique also removes a more difficult type of "staining." New studies show that a tenacious, non-bacterial, discoloring protein "skin" builds up on the tooth enamel of about one patient in five in the absence of abrasive action. It appears pale yellow in some individuals, while in others it is darker, even slowly assuming a brownish cast.

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TEEL's New Technique removes this discoloring "skin" too... but removes it safely. The patient simply brushes with TEEL twice daily—plus one extra minute a week spent brushing with TEEL and plain baking soda.

This technique provides *daily* non-abrasive cleaning—with just enough abrasion each *week* to remove the discoloring "skin." *There's no needless, dangerous daily abrasion.*

LEADING TOOTHPASTES AND POWDERS MAY DAMAGE TEETH, TESTS SHOW

Under identical conditions, the same teeth were brushed with TEEL or plain water, and—on the reverse surface—with toothpastes or powders. Each test was approximately equal to 6 years' brushing *in vivo.*

Depth of Abrasion of Cementum and Dentin (in hundredths of m.m.)

Toothpowder	A	79.0
"	B	62.6
"	C	82.3
Toothpaste	A	46.3
"	B	40.6
"	C	55.0
"	D	33.4
"	E	18.5
"	F	32.5
"	G	44.3
BRUSH AND WATER		0.5
BRUSH AND TEEL		0.0

Above tests reported in Jrnl. of Dental Research, 20 *583-95 Dec. '41;* 21 *335, June, '42.*

TEEL'S NEW TECHNIQUE consists of

1. Twice daily—Brush the teeth with TEEL; a few drops on dry or moist brush. Provides daily hygiene with no abrasion.

2. Weekly—Brush teeth for at least one extra minute with plain baking soda on brush moistened with TEEL. Necessary abrasive action each week to remove surface "stain."



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Published by The C. V. Mosby Company, St. Louis

American
Journal of Orthodontics
and Oral Surgery
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VOL. 29 JUNE, 1943 No. 6

Original Articles

PRESIDENT'S ADDRESS

SOUTHWESTERN SOCIETY OF ORTHODONTISTS

E. FORRIS WOODRING, TULSA, OKLA.

AS I TURN the cycle of years backward in my mind to the year I became a member of this Society, and view the records and accomplishments of the presidents who have served before me, it makes me feel more deeply my inabilities to succeed such a brilliant array of talent. Each one, year by year, with the full cooperation and help of every member of this organization, progressed to greater heights of professional standards, presented programs that exemplify the latest and best to be found in orthodontics of today.

The achievements of our Society under such able leadership are indeed gratifying. This should make anyone feel proud to be a member and enjoy the association's many privileges.

At this time I want to thank each and every one of you for the privilege of serving as your president for the past two years. Personally I feel no greater honor could be bestowed upon anyone.

Since we last met our country has been ruthlessly and cruelly attacked. We have been wounded and are bleeding unto death. We have been asked to sacrifice and give to the utmost. I am certain every member of this organization has responded to the limit of his abilities. Some are offering all—like the great men this Society is composed of—and have presented themselves as a transfusion, so to speak, that our country may recover from its wounds and preserve the American way of "Life, Liberty and the Pursuit of Happiness," of which the infamous trio of murderers is trying so desperately to deprive us. We are proud of our boys who have so gallantly volunteered their services. May they glorify our country and distinguish themselves with honor in their chosen fields of service. May they return to us better men, that we may become a better Society in the knowledge that they have helped to make a better and safer world in which to live.

Read before the meeting held at Tulsa, Okla., March, 1943.

As I have no resolutions nor recommendations to offer, may I make some observations regarding our ever-changing picture of conditions caused by the war effort? Grave problems are being created in the handling of practices because of extreme changes in the economic situation. Aside from the usual sources of orthodontic patients, an entirely new type is presenting itself for treatment, without any knowledge of what is required in methods, time, or money, creating a very unstable situation, due to employment and uncertainty of location. This group that we encounter, with the number of transfers, is placing a burden on time and ingenuity; and, I am sure, creates a problem for us all.

It is my opinion that the future of our members in the service, as well as our own specialty, must be protected against various encroachments on our present high standards of orthodontics. Our diagnosis, appliance construction, and treatment must be maintained at our present level if we are to preserve the ideals of orthodontics for future posterity.

The depletion of manpower in general dentistry, as well as in our own specialty, brings us face to face with another problem—that of receiving adequate dental hygiene for our own patients. I do not think it is a question of whether or not they shall receive it, but by whom will it be provided. Even at this time we are finding it more and more difficult to obtain appointments for checkup and the necessary prophylaxis and repair. Let me remind you that the time may be shorter than you think when we may have to assume this—shall we say, patriotic responsibility—, and render this service in a limited way for the best interest and protection of the patient, as well as ourselves.

It seems to me that our responsibilities to the communities in which we practice increase as the ratio of the general dentist decreases in the maintenance of general dental health. Therefore, necessity may bring about a situation that would suspend rules and regulations governing the operation of any organization. I am sure, as good Americans, we will not fail to render any aid that may be required of us. Should it become necessary for us to assume these increased duties, may we accept them in a spirit of patriotic and humanitarian service.

Unfortunately, mass treatment cannot be applied to orthodontics because scientific principles must be correlated with normal physiologic growth and development.

We all realize there is a definite limit to the number of patients we can adequately treat. I feel there never was a time when unified effort was more necessary than at present if all the essential interests of orthodontics and the faith of the public in us be kept.

As our government has found it necessary to ration almost all essential commodities of food and clothing, we also, may find it necessary to ration our practices; but never the principles on which this Society was founded.

As the vision of our future seems dimmed by the clouds of war, which threaten to black out further meeting for the duration, our activities should not cease and our governing bodies must be kept alive and functioning as in the past, until we get the "All Clear" signal to carry on. Our past has been brilliant

and without much expense. Let us use it as a mirror to the future and whatever the cost, it will not be too much.

At this point I wish to thank the essayists and clinicians for their willingness to be conscripted for this program. My sincere thanks to all committee members who assure us of a smoothly functioning meeting.

I am sure the program committee has worked long and hard under a severe handicap to prepare this program for your benefit and enjoyment. It is with sincerity that I express my appreciation for the efforts of all officers, The Board of Censors, and especially the Board of Directors for their unselfish service to this organization, willingly sacrificing their time and energy without any thought of remuneration, but only of the priceless comradeship and friendly association of all its members. Again I wish to thank you for the honor you have extended me. I am grateful to you for permitting me to serve in my humble way.

THE INFLUENCE OF THE THIRD MOLARS ON THE ALIGNMENT OF THE TEETH

B. Holly Broadbent, D.D.S., F.A.C.D.,* Cleveland, Ohio

IN THE preliminary announcement of this symposium, your President, Dr. Claude Wood, referred to the third molars as "the fifth columnists of orthodontic practice." This statement expresses in a very terse manner the popular belief, shared alike by the dental profession and their not too well informed patients. Today our orthodontic practices include an increasing number of youngsters whose parents relate to them the "joys" of wearing braces for years, ultimately to reach that stage of development marked by the surgical removal of the wisdom teeth.

Those of us who have searched the records published in the past twenty-five years on this subject have been rewarded with a list of over 500 articles. Of these over 90 per cent offer diverse methods for third molar extraction and supply little or no useful information regarding when or why their removal is necessary in the *growing individual*. The relatively few scientific and useful contributions in orthodontic literature bear the names of Anderson, Barnes, Hellman, Henry, Kelsey, Ketcham, Moorehouse, Noyes, Young, and others whose works should be familiar to all of us. Yet on the whole our archives are a record of confusion that blindfolds the average clinician who is left to make his own deductions empirically.

Like most of you who have practiced ten years or more, I have seen some of my best results relapse upon reaching the late teen age and become an utter failure in the eyes of the patient and the parents through the collapse of the lower dental arch coincident with the partial eruption or impaction of the mandibular wisdom teeth. Like a few of you, I have had the opportunity to observe this syndrome appear also in individuals who have not been under orthodontic treatment. Like all of you, I, too, desired a method of making a sound diagnosis and prognosis of the impaction of third molars and the concurrent crowding of the anterior teeth.

During the past fifteen years it has been routine office practice for me to make cephalometric roentgenograms of the developmental growth of my patients. It is from these records of more than 1000 individuals and from the records of the Bolton Study of Normal Development of the Face of the Growing Child that I draw my information and observations on the subject under discussion.

Figs. 1 and 2 show a typical pair of lateral and frontal standardized cephalometric roentgenograms. This command of registration of the internal as

Read before the First Inter-American Orthodontic Congress and the American Association of Orthodontists, New Orleans, La., March, 1942.

*Director of the Bolton Fund, Department of Anatomy, School of Medicine, Western Reserve University.

well as the external changes in the living head precisely records the progress of developmental growth of the teeth and jaws in relation to the cranial base in three planes of space. When we compare such records made of the same child at quarterly and semiannual intervals, they clearly reveal the growth of the teeth in relation to the development of the face.

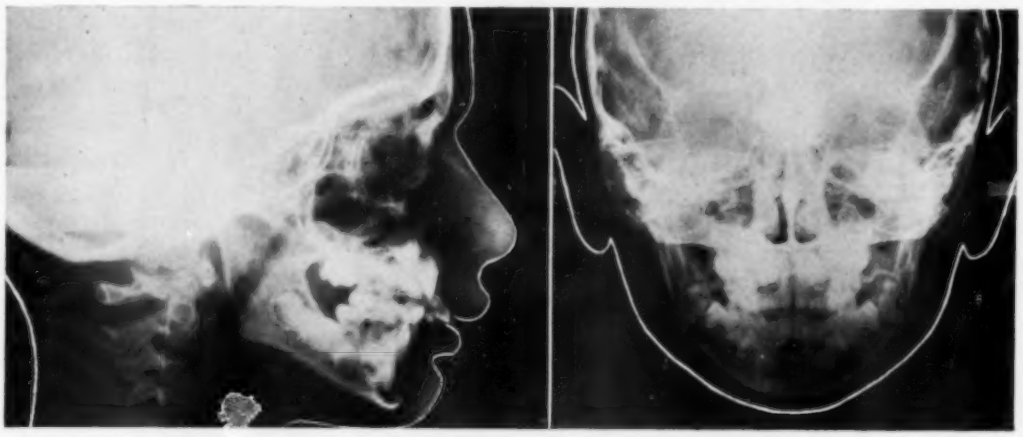


Fig. 1.—Standardized lateral and frontal orthodiagraphic roentgenograms oriented for tracing and measuring dentofacial structures. Tracings are shown in Fig. 2.

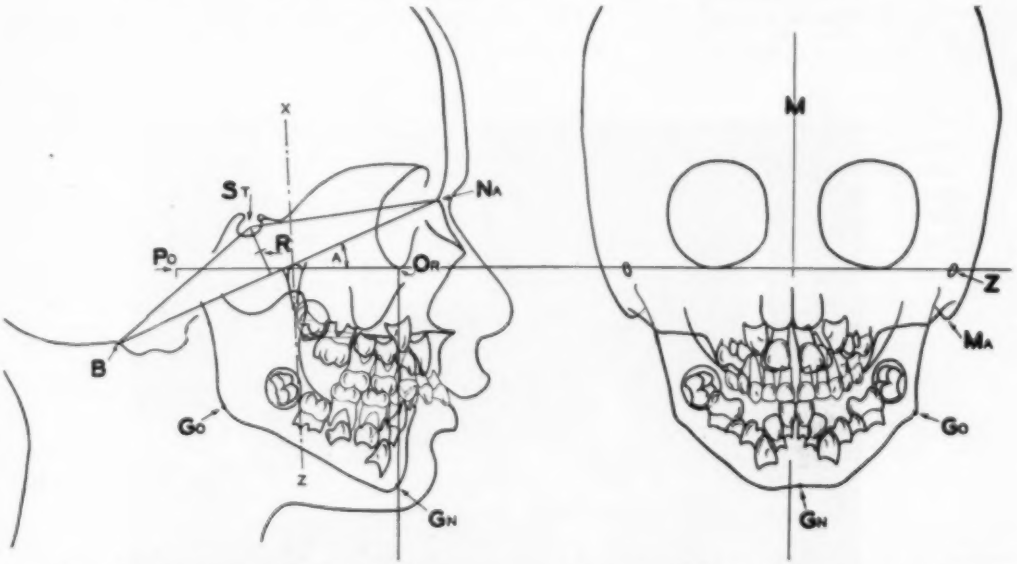


Fig. 2.—Tracings of Bolton roentgenograms shown in Fig. 1, including some of the deciduous and permanent teeth and several of the anatomic landmarks. *B*, Bolton point. *GN*, Gnathion. *GO*, Gonion. *M*, Median plane. *NA*, Nasion. *OR*, Orbitale. *PO*, Porion. *R*, Registration point. *ST*, Sella Turcica. *XZ*, Anteroposterior growth axis. *Z*, Zygomatic arch.

Unlike the head spanner and calipers used by the anthropologists to take direct measurements of the head and face, the cephalometer is merely a means to maintain and replace the head of an individual in a standard relation to the x-rays and the x-ray film. The developmental growth changes are measured from the resulting roentgenograms. Fig. 3 shows the head adjusted to the cephalometer with the film holder or cassette in place for the lateral view.

Fig. 4 shows the head maintained in its original position after the exposure and removal of the lateral cassette and with the cassette in front of the face for

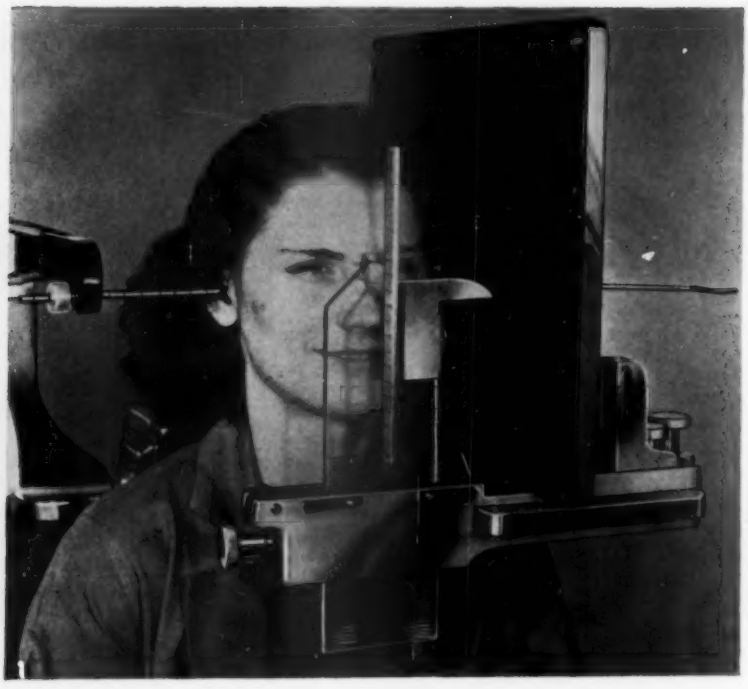


Fig. 3.—Patient's head adjusted to the Broadbent-Bolton cephalometer. Lateral cassette and scale in place for profile roentgenogram. (Photo through courtesy of General Electric X-ray Company and Northwestern University.)



Fig. 4.—Patient's head retained in the cephalometer as in Fig. 3. Scale removed and cassette in place for frontal roentgenogram. (Photo through courtesy of General Electric X-ray Company and Northwestern University.)

the posteroanterior or frontal view. The apparatus does not hold the head in position by force but rather allows the head to be comfortably related to its various parts without strain or tension. The full details of the technique may be found in our orthodontic literature.[1-5]

A brief description of the method of relating the serial records is necessary here in order fully to comprehend the preciseness with which this command of registration discloses the growing-up process of the teeth and jaws. Since our subject dictates and limits our discussion, I shall therefore draw only on those records that will, first, make clear our comprehension of the changes in the molar areas that take place in the face and jaws during normal growth and, second, show the clinical applications of the normal patterns to the records of individuals that deviate therefrom. The method of superposing or relating the subsequent records in Fig. 5 to the original record made at one month consists first in determining the Bolton cranial base plane *"BNa,"* *"Na"* being the craniometric landmark Nasion at the junction of the frontal

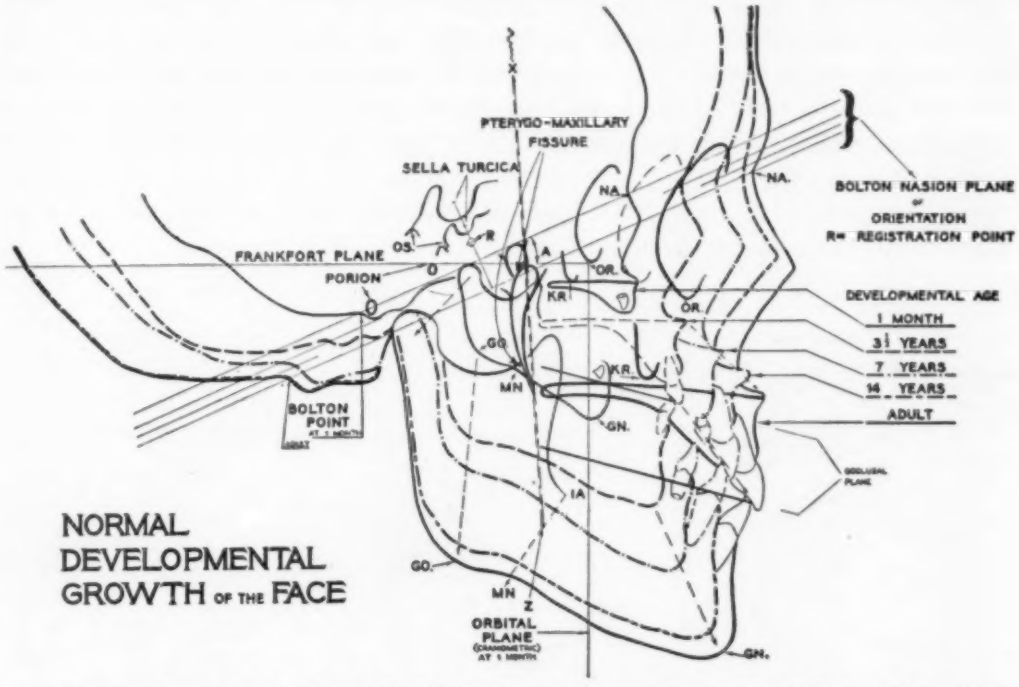


Fig. 5.—Chart of normal dentofacial developmental growth from the Bolton study records. *GN*, Gnathion. *GO*, Gonion. *IA*, Internal angle of the mandible. *KR*, Key ridge. *MN*, Mandibular notch. *NA*, Nasion. *OR*, Orbitale. *OS*, Occipito-sphenoidal suture. *XZ*, Anteroposterior growth axis.

bone with the nasal bones in the midline. The Bolton point *"B,"* defining the posterior end of this plane, is in the midline at about the center of the foramen magnum; its site is recorded on the lateral x-ray film as the highest point in the notch at the posterior end of the condyles on the occipital bone. After locating the center of the sella turcica, *"St,"* a perpendicular is erected from the Bolton plane to *"St"* and the mid-point, *"R,"* along this perpendicular is used as the registration point. Subsequent records are then superposed upon the initial record with the "R" points registered and the "BNa" planes parallel. To facilitate our understanding of anteroposterior and vertical changes in the

face, we include the Frankfort plane "*F*" of the first record which is maintained at its original angle "*A*" to the Bolton plane throughout a series of pictures of the same individual. Thus by noting (Figs. 5 and 6) the growth changes in the face in relation to the original Frankfort and orbital plane, we secure an exact measure of the developmental growth progress, downward and forward.

We will confine our observations to the posterior portion of both jaws and focus our attention on the changes in relative position in the molar series. Three of a series of lateral records of the same child at one month and 3 years and 9 years are contained in Fig. 6. In the one month record (*A*) will be seen the partially calcified crowns of the deciduous teeth occupying the upper half of the body of the mandible, while the crypt of the first permanent molar is located in the ascending ramus. The junction of the body of the mandible with the rami is along the line from the internal angle, "*IA*," to the mandibular notch, "*MN*." As the jaws continue to enlarge, the teeth keep pace, moving forward within the bone just as they do after they have entered the oral cavity. Usually by the ninth month the cusps of the first permanent molar have united to form the occlusal surface while the crypt and its contents migrate downward and forward into the body of the mandible. In the upper jaw the crypt of the first permanent molar is found above the site of the tuberosity of the maxilla; in fact, it is above the level of the floor of the nose. By the time its occlusal surface is complete, it has moved downward, forward, and outward to approach its place distal to the second deciduous molar.

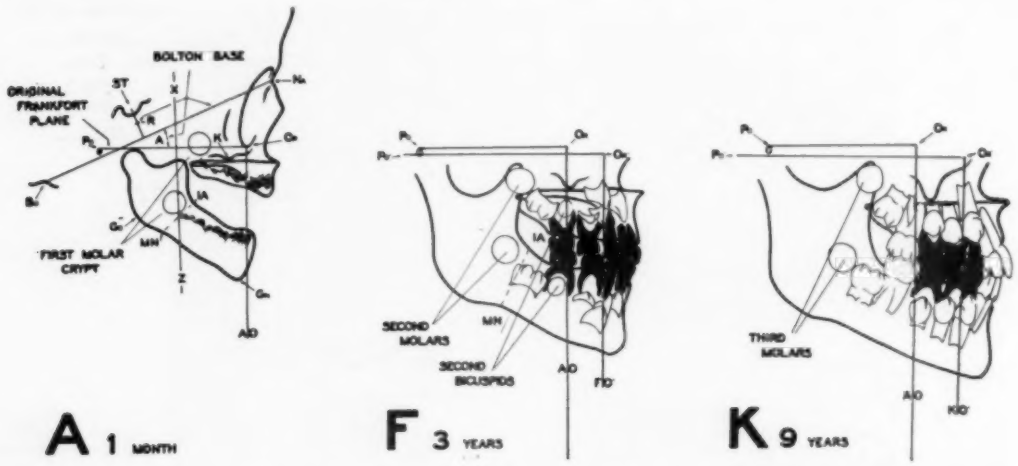


Fig. 6.—Bolton study records of the same child showing the site of origin of the permanent molar teeth.

About the third year (Fig. 6 *F*) the maxillary first molar enters the developing tuberosity of the maxilla. In the lower jaw the first molar crown, like that of the upper, is about complete and is located almost entirely within the body of the mandible, below, behind, and lateral to the crown of the second deciduous molar. At this age the crypts in which will calcify the maxillary and mandibular second molars appear at the sites previously occupied by the first permanent molar crypts at birth, so we see that the development of the second permanent molars is a repetition of the developmental growth process of the first permanent

molars. Note that the changes in the axial inclinations of the maxillary and mandibular second permanent molars are identical to those of the first permanent molars.

The Bolton technique picks up by the ninth year the appearance of the crypts in which the maxillary and mandibular third molars calcify. Note in Fig. 6 *K* that the site of origin of the wisdom teeth in relation to the maxilla and mandible is identical to that of the first and second molars and that the second molar crowns are complete when the crypts of the third molars appear in the bone. If the developmental growth of the face has not been retarded in progress toward its destined size for its age, then and only then will there be sufficient space in the jaws for all teeth to occupy their normal position whether they have erupted or not. At the time of eruption of the permanent teeth, if the supporting bones are not harmonious in size with the dental organs, then the teeth assume positions similar to those that they occupied within the bone at a younger stage. In proportion to the degree of retardation of the supporting bones the teeth are forced into a greater or lesser degree of malposition and malocclusion. This dwarfing of the facial bones denies the permanent molar teeth sufficient room to erupt normally and on schedule time.

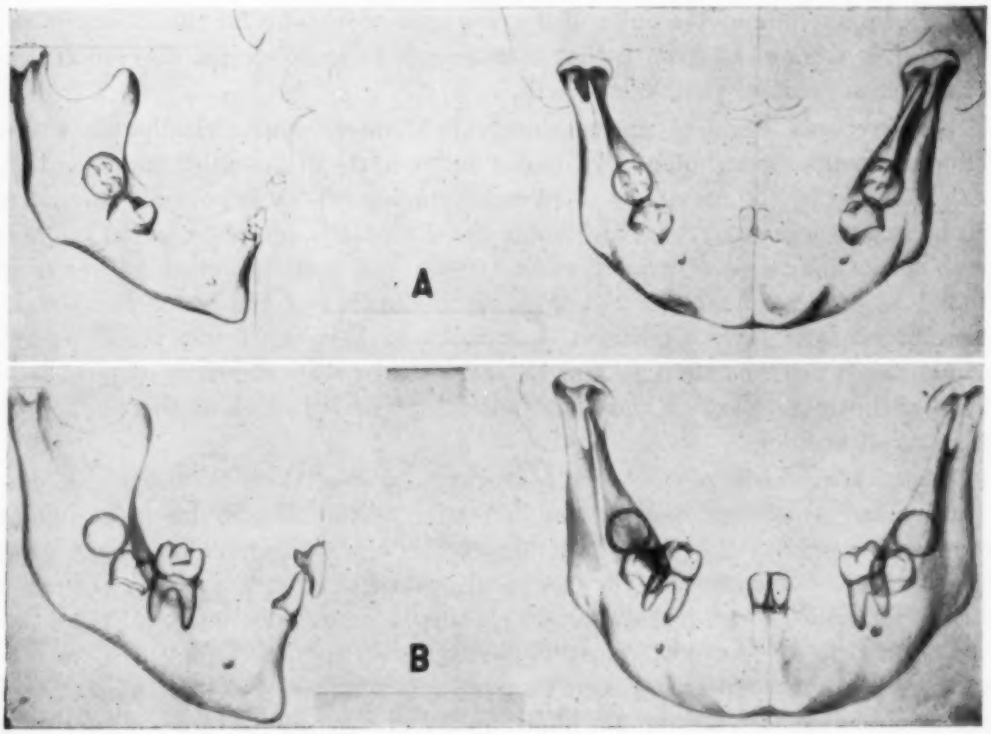


Fig. 7.—Lateral and frontal tracings of Bolton records of the same child at 4 years and 10 years. Note the similarity of the relationship of the second to the first molar at 4 years (*A*) and the third to the second at 10 years (*B*).

Turning to the frontal view, Fig. 7, we see how the complimentary frontal x-rays disclose the changes in relative position as the face expands in width. Since the still pictures of these relatively few levels of developmental growth do not disclose the constant changing, tipping, and shifting of the teeth as do the

animated motion pictures, we visualized the developmental growth cycle of the wisdom tooth to better advantage in the movies shown during this presentation.

These movies were made by photographing in chronologic sequence the drawings of the serial records of the same individual from the time of appearance of the third molar crypts to their arrival in the mouth in complete occlusion. These animations with their accompanying legends and titles depict the growing-up portion of the life cycle of the developing dentition like the unfolding of a flower.

The first scene contained the second permanent molars at the 9-year stage as well as the crypts of the third molars so that the changes in relative position of the third molars to the seconds were seen while these teeth migrated toward their adult position in the dental arches. The root ends of the second molars shift forward as these teeth assume the erect posture of their adult stage. This takes place in a relatively shorter period of time than that of the third molars and, as has been pointed out in the figures, is the same process for each of the three permanent molars. It will be seen that the face continues to grow slightly beyond the time that the root ends of the third molars are completed after these teeth have reached functional occlusion. The superposition of the adult record over the one of the child of 9 years gives a measure of the direction and the relative amount of growth that is necessary to complete the development of a full complement of permanent teeth.

The records made at annual intervals show very graphically the course followed by the mandibular third molar on its route to the adult stage, and the path followed by the maxillary third molar during this same period. As soon as the occlusal surface of the mandibular third molar is complete, we are able to establish its long axis of growth of the crown and root formation and have included here the annual changes in axial inclination of the lower third molar from 12 years to early adulthood. Again let me emphasize that the important change takes place between 16 and 18 years of age when the roots of these teeth move abruptly forward in the bone indicating the approach of the tooth to its adult axial position.

A careful study of the frontal roentgenograms that disclose much more clearly than words can describe the migration of the mandibular molars downward and forward out of the rami and into the body of the mandible from which position they erupt upward, forward, and inward to enter the mouth at the posterior end of the lower dental arch. This should impress upon us that more than two standardized roentgenograms of the face with the developing wisdom teeth must be taken at regular intervals to determine whether or not the wisdom teeth are progressing normally or are likely to remain partially or wholly unerupted.

As the normal face completes its progress toward maturity, room for the third permanent molars becomes available and they, like their forerunners in the permanent molar series, "wiggle" their way toward the occlusal plane cutting through the soft tissues into the oral cavity to complete the permanent dentition. About the time that the crowns of the last permanent molars are complete (around the fourteenth year), the handicaps suffered by an individual who has been thwarted in nature's plan to achieve full development of the skele-

tal structures deny the third molars their scheduled eruption. This failure of the face to provide enough room for the teeth is likewise apparent in the anterior segment of the dental arches for it prevents the incisors, particularly the mandibulars, from maintaining their normal position in the line of occlusion. Any buckling of the lower dental arch at this stage is usually attributed to the so-called pressure sabotage of the erupting third molars. Fig. 8 illustrates two cases that show contrasting third molar eruption. "*A*" contains the first and last records of the same individual at 13 and 18 years of age, representative of the Bolton group of individuals in this age range who have enjoyed excellent facial development, and consequently, have room for the erupting third molars. In contrast to this, "*B*" is a record of aberrant facial development with the resulting third molar impaction.

Factual evidence collected by the Bolton Study for the past twelve years would acquit the wisdom teeth of the "fifth column" charges and include them along with the incisors as cosufferers resulting from the failure of the facial skeleton to attain its complete adult size and proportions.

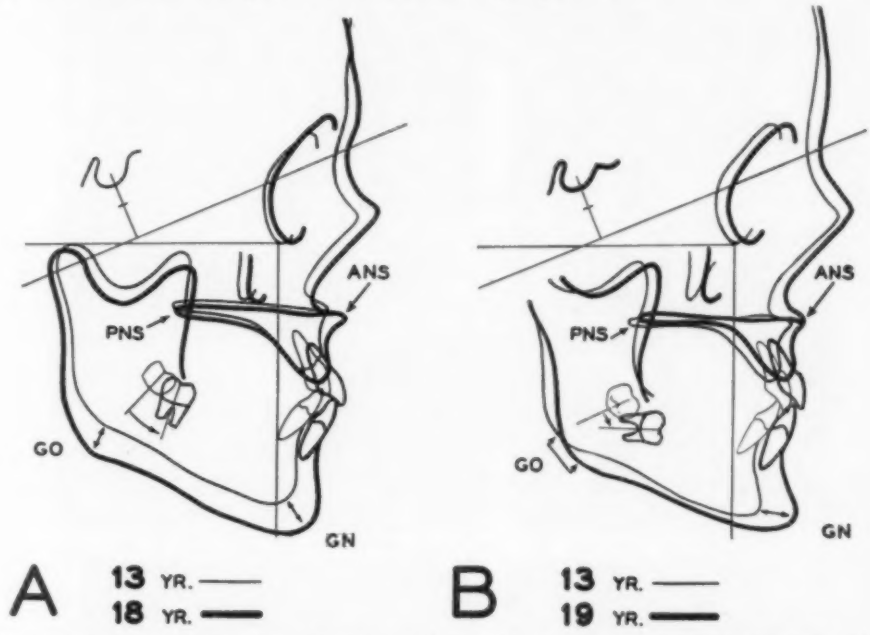


Fig. 8.—Superposed tracings of the same individual through late adolescence, reveal in *A*, the normal trend of facial development accompanied b, normal eruption of the third molar, while in *B*, the abnormal trend of facial development is accompanied by impaction of the mandibular third permanent molars.

It seems appropriate now to offer a word of warning to those who would gather from the foregoing description of normal facial development that there are no individuals whose faces recover from early handicaps. There are in fact many who recover and ultimately attain sufficient size and proportions to accommodate in normal occlusion their full complement of permanent teeth. This series (Fig. 9) of clinical roentgenograms of a patient of 11 years to 22 years 3 months is a typical illustration of such a recovery. In the first registration (*I*), when this boy was 11 years of age, may be seen the retarded developmental growth of his left side as compared with the more normal growth on the right side of his face. Although the right side too is slightly retarded according to

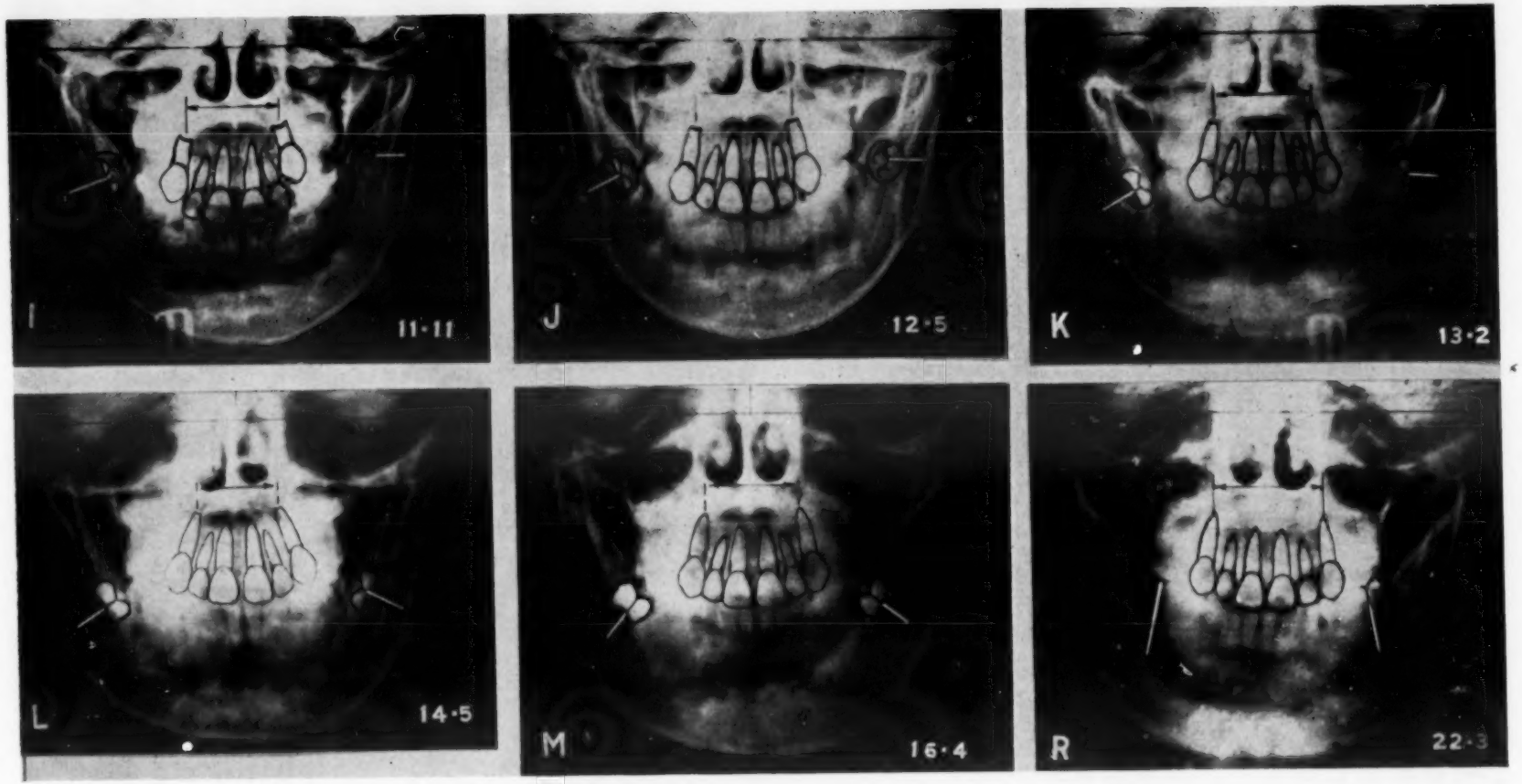


Fig. 9.—Serial cephalometric roentgenograms of the same patient at the ages shown. Note the retarded development on the right side as compared to the left, particularly the developing third molars.

the Bolton standards, it is in advance of the left side of his face as evidenced by the amount of calcification of the third molar. On the more normal side the occlusal surface of the third molar is partly formed in contrast to the absence of calcification in the crypt of the third molar on the left side. The retardation

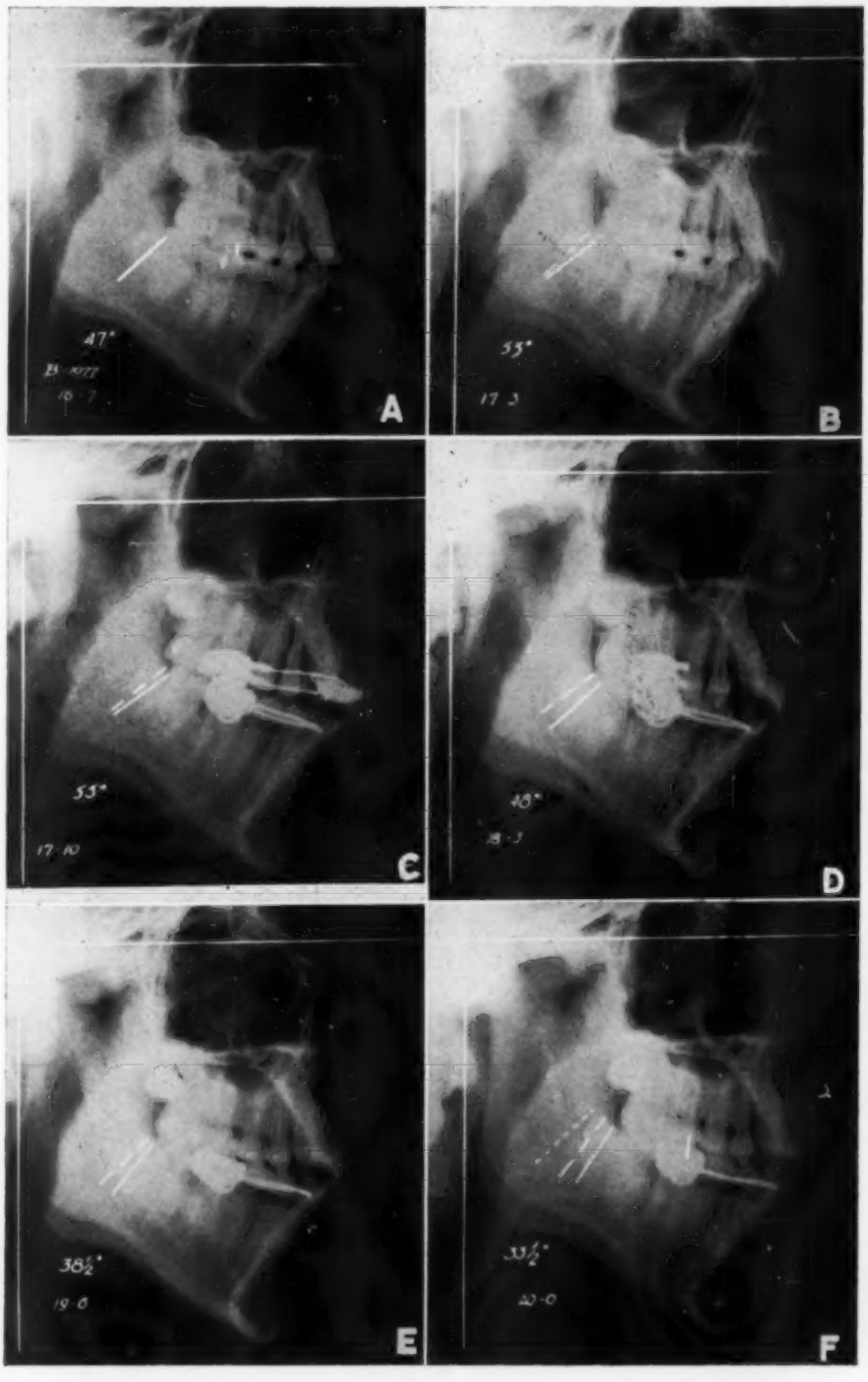


Fig. 10.—Serial cephalometric roentgenograms of an orthodontically treated case. Note the fluctuation in axial inclination of the developing mandibular third molar. See complimentary frontal views in Fig. 11.

in development on the left side is also evident in the anterior segment of the arch when one compares the position of the maxillary permanent lateral incisors and cuspids. When this boy was 1½ years older his record (*J*) at 12 years 5 months compared with the original record reveals that there has been some progress in calcification as well as eruption. By the thirteenth year (*K*) there has apparently been a spurt in calcification in the left third molar accompanied by a normal change in relative position, downward and forward

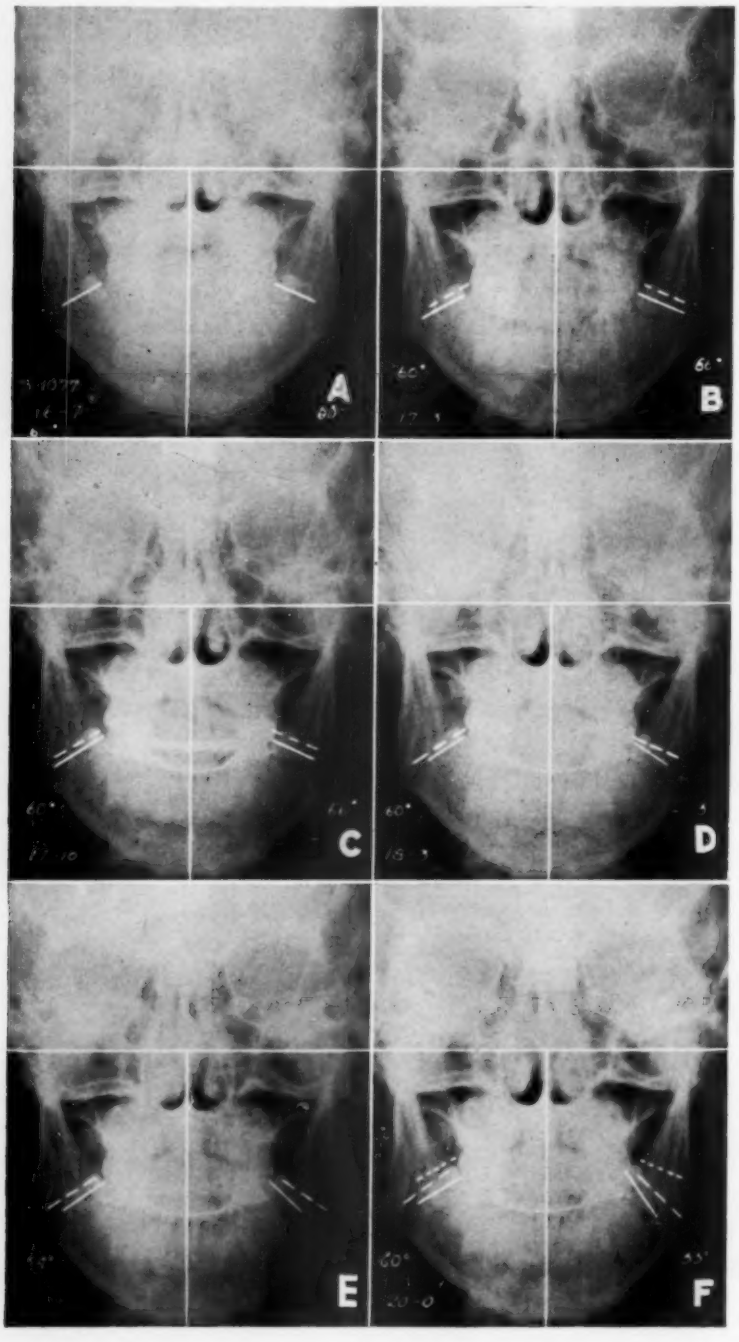


Fig. 11.—Complimentary frontal roentgenograms of the lateral views shown in Fig. 10.

along with a change toward normal inclination. Continuing this method of assessing progress, one has only to compare in the same manner the subsequent records (*L, M, R*), taken at biannual intervals to see the almost complete recovery of the left side when compared to the right side, and we find the case closely approximating a normal Bolton standard for its age, 22 years 3 months. This record of progress dictated and confirmed the diagnosis and prognosis that mechanical stimulation was contraindicated.

Figs. 10 and 11 are the lateral and frontal records of another individual between 16½ and 20 years of age. This dentition was classified as an Angle Class I malocclusion with crowded maxillary incisors accompanied by the loss of space for both maxillary cuspids due to the forward migration of the premolars and molars which forced the cuspids to erupt above and outside the line of occlusion. The case was treated with Class II mechanics and retained with a lower removable lingual arch and upper Hawley plate. The long axes

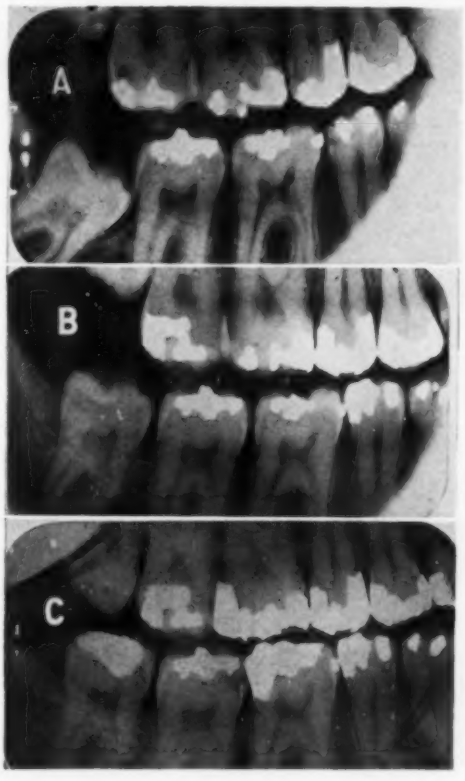


Fig. 12.—Dental roentgenograms of the same patient showing third molar eruption at 17 years, 10 months (*A*), 19 years, 0 months (*B*) and 22 years, 3 months (*C*). Compare with the cephalometric records shown in Fig. 13.

of the developing mandibular third molars are shown in each registration. It is interesting to note that between 16 years 7 months and 17 years 10 months the axial inclination in the profile views shows the tipping downward and forward of the crowns of these teeth to the extent of 8 degrees with a subsequent recovery in axial position between 18 years and 20 years of 22½ degrees. A checkup of this case at the age of 24 years found the mouth with the full 32 teeth in functional occlusion and normal alignment.

The dental x-rays of another young man taken when he was 17 years 10 months and 19 years as shown in Fig. 12 offer an opportunity to emphasize the importance of securing a three-dimensional record, either an occlusal view with a dental film or a frontal view with the head plate in order to determine the buccolingual relation of the last two developing molars. Fig. 13 taken when this boy was 10 years 4 months old discloses that his wisdom teeth began their development with their occlusal surfaces almost facing each other and their long axes nearly horizontal. The drawing shows the change in axial inclinations up to and including the position of these teeth in full functional occlusion. These clinical records which give both the progress of facial developmental growth and dental eruption are as necessary to the conduct of a modern orthodontic practice as dental x-rays are to the practitioner of general dentistry.

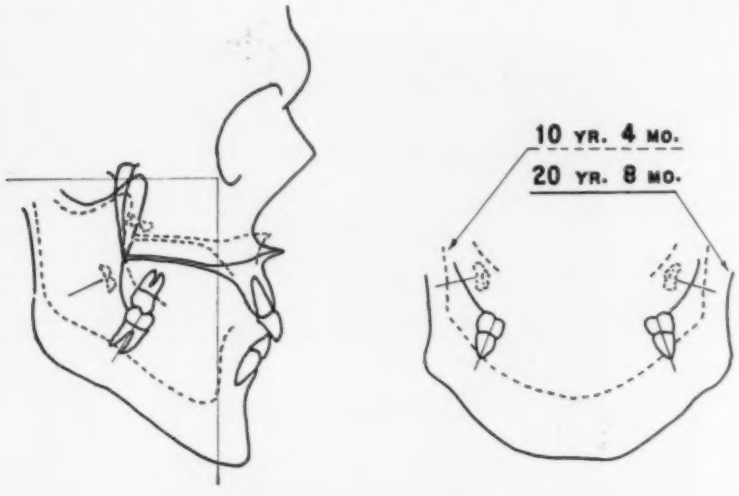


Fig. 13.—Tracings of cephalometric roentgenograms of the patient whose dental X-rays are shown in Fig. 12 reveal the marked change in angulation of the mandibular third molars from beginning of calcification to complete eruption.

In order not to overlook the possible value that bite wing or lateral jaw x-rays may be to the scientific interpretation of our problem I have included here in Fig. 14, two lateral jaw pictures and their tracings taken from the work of two Englishmen, C. B. Henry, and G. M. Morant, published in *Biometrika* by the Cambridge Press in December, 1936.[6] These workers concluded that the relation of the mesiodistal diameter of the mandibular third molar when expressed as a percentage of the space between the second molar and the anterior border of the ascending ramus gave them their so-called third molar space index and "suggested that it may be accepted as a measure of the severity of the impaction for individuals age 22 and over." They further state that their published report "is only a preliminary investigation and the results seem to justify the conclusion that suitable material worked up on the same lines would lead to a satisfactory solution of the problem discussed. The need is for repeated radiographs of a sample of 100 individuals taken at intervals of a year between their sixteenth and twenty-second birth-

days. More suitable films than some of those used in this investigation would be required and the metrical results obtained should be correlated with clinical records."

The semiannual Bolton records throughout the second decade show very conclusively that frequent records are needed before the sixteenth year, preferably beginning at 14 years when the crown portion of the third molars is usually completed.

Thus far we have discussed the correlation between normal facial development and the eruption of the wisdom teeth, so now we are ready to consider the effect on the face of the complete absence and late calcification of the third molars. This orthodontic problem has been scientifically investigated and reported on in one of the many valuable contributions by Milo Hellman.[7] In his publication entitled, "Our Third Molar Teeth: Their Eruption, Presence

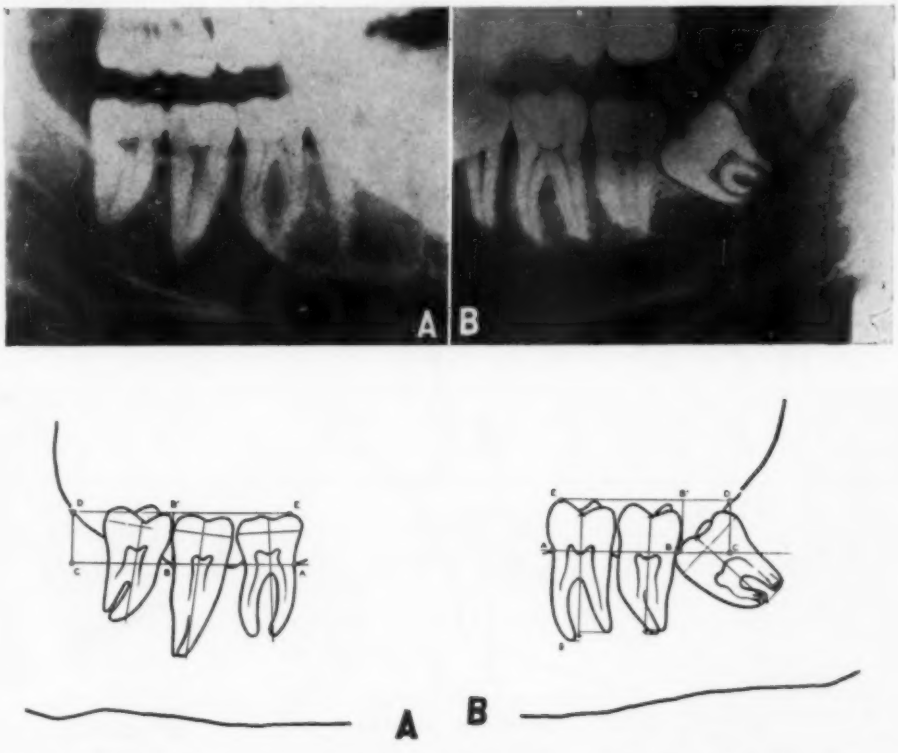


Fig. 14.—Lateral jaw roentgenograms and their tracings from C. B. Henry and G. M. Morant. *A*, An adult over 22 years of age and *B*, probably 18 years or less. Note the incomplete root formation of the mandibular third molar. (From *Biometrika*, January, 1938.)

and Absence," we find in his table "Comparisons of Facial Dimensions of Columbia University Students Grouped According to Present, Unerupted and Absent Third Molars": "If now comparisons are made between the group having impacted third molars and that group having them present, differences appear in all dimensions. The faces of those having three and four impacted third molar teeth are all smaller than those having them present. Moreover if comparisons of facial dimensions of the group having impacted third molars are made with those whose third molars are congenitally missing . . . the vertical dimensions of the faces of the latter group are smaller."

In order to better comprehend and interpret the effect of the third molars on the developmental growth of the face, we have selected the records of individuals with the congenital absence of four or more teeth. The first illustration (Fig. 15) reveals how profoundly the facial development is affected by the congenital absence of a large number of teeth of both the deciduous and permanent dentitions. The roentgenograms of this boy at the age of 4 years revealed the congenital absence of twenty-four teeth, ten of the deciduous teeth and fourteen of the permanent set. Ordinarily before the fourth year the deciduous dentition is complete and twenty-eight of the permanent teeth have begun to calcify or have partially completed the calcification of their crowns. Assessed on the basis of the Bolton standards the developmental age of this face would be equal to that of a 2-year-old child. Although his face is dwarfed in all three dimensions, it is most markedly retarded in its vertical growth. Superposed on his maxillary and mandibular outlines is the outline of the Bolton standard for four years, this superposition pictures graphically the sites of the defect and the retarded areas.

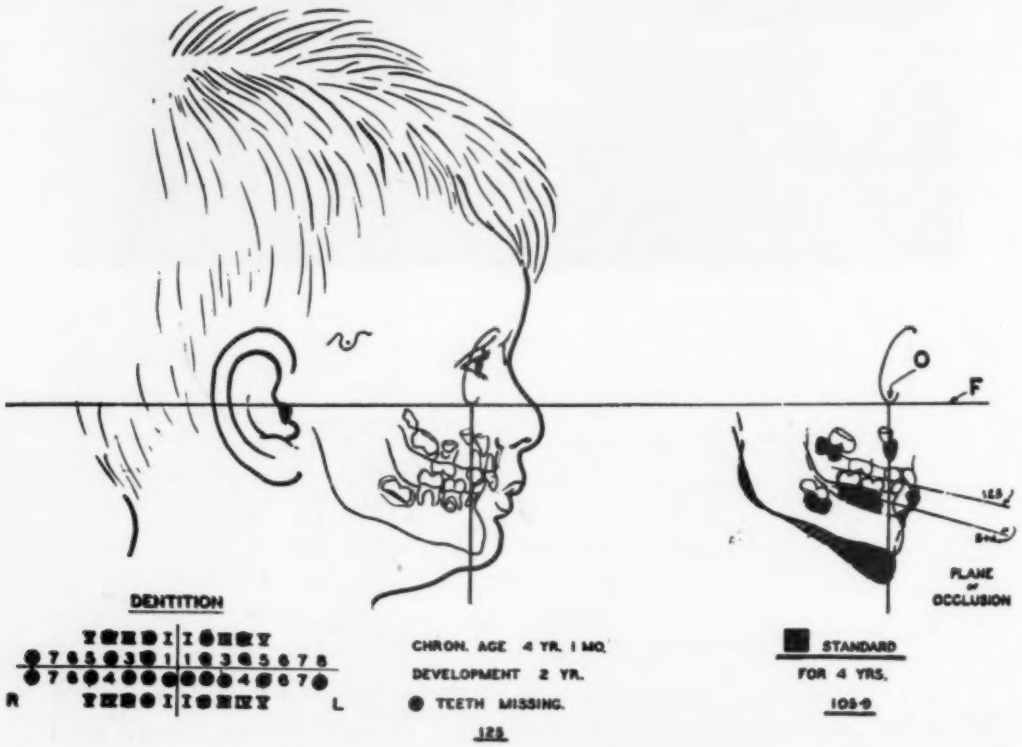


Fig. 15.—Four-year-old child with congenital absence of eighteen teeth as indicated in chart. Note failure in developmental growth of the face.

The subsequent record of this individual presents a very vivid history of the effect of the congenital absence of teeth up to about the sixteenth year when the most recent roentgenograms of this case were made. This is shown here in Fig. 16. The greatest defect is the failure of the dental arches and the supporting alveolar bone to approach their normal size and relative position to their maxillary and mandibular bases, principally in the anterior-posterior relationship. In other words the dental arches failed to develop for-

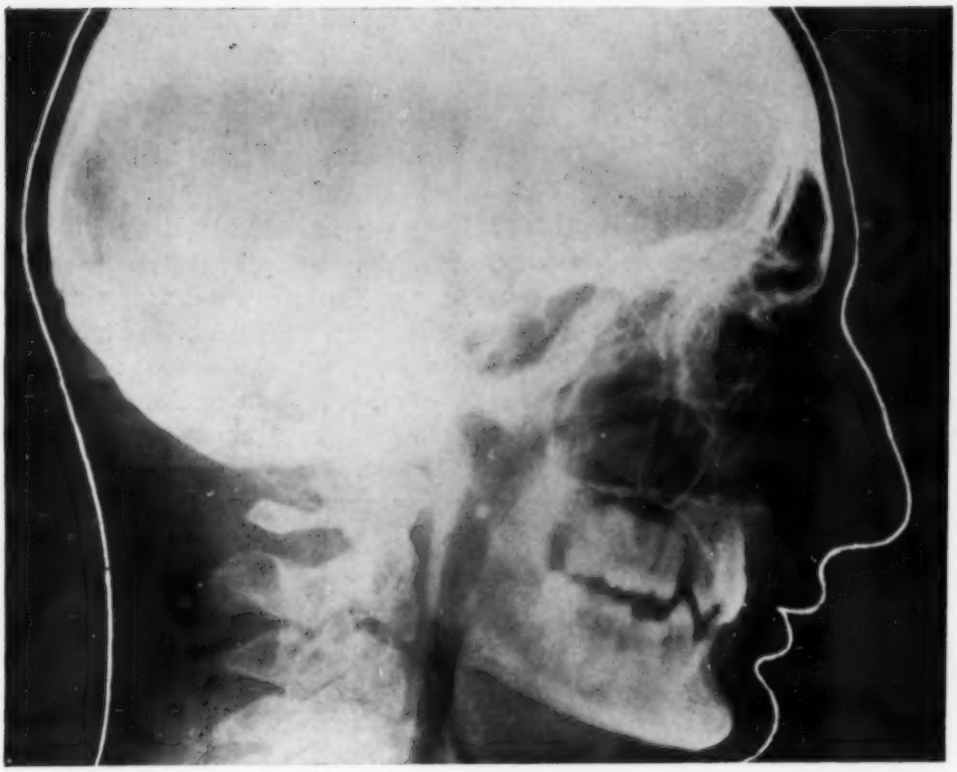


Fig. 16.—Lateral roentgenograms of the same boy shown in Fig. 15 when he was 16 years old disclose congenital absence of twenty-three deciduous and permanent teeth.



Fig. 17.—Lateral cephalometric record of an individual, aged 30 years, with congenital absence of ten permanent teeth, mandibular central and lateral incisors and right third molar, maxillary lateral incisors, second premolars and left third molar.

ward to fill out properly the lower half of the face, thus producing a concave profile that gives the external features a weak and senile appearance. Intermittent attempts have been made to stimulate the growth of this face, and some benefit has resulted. The continuous wearing of a bite plate has artificially supported the bite and prevented further collapse of the dental arches and the drifting of the two maxillary incisors and cuspids.

The lateral roentgenogram (Fig. 17) of an older individual, aged 30 years, with the congenital absence of ten permanent teeth indicated on the accompanying chart, is additional evidence of a similar defect, but to a milder degree than the record of the younger individual just described. With a clearer understanding of the effect on the face either of early loss or absence of many teeth, we are now in a position to recognize more easily the same symptoms in faces where the dentitions lack only a few of their dental organs.



Fig. 18.—Profile photographs taken at 13½ years (*A*) and at 18½ years (*B*) of a young lady with congenital absence of all four second premolars.

Shown in Fig. 18 is a case with the congenital absence of the four second premolars; when first seen by me at the age of 13½ years the child had received orthodontic treatment elsewhere. The case was under retention with a lower cuspid to cuspid lingual retainer and an upper Hawley bite plate. The original models of the case showed that the second premolar spaces were more than half closed before treatment was started and the operator decided against opening the spaces for the artificial restoration of the missing teeth. During the interval between 13½ and 18½ years the anterior-posterior dimensions of the face had halted but there was slight increase in vertical dimension. The relation of the teeth and dental arches to their maxillary and mandibular bases is typical of those individuals with incomplete or mutilated dentitions. Whether or not this compromise treatment, particularly in cases where the individual has a record of excellent facial development, is to be

preferred over the restoration of the missing teeth is a matter that can be decided by instituting the procedure of recording the progress of facial development before any compromise is carried out.

Now to turn to the final illustrations, typical of a group in the Bolton Study and the author's practice, where we find the influence of the developing third molars lacking either because of their congenital absence or their

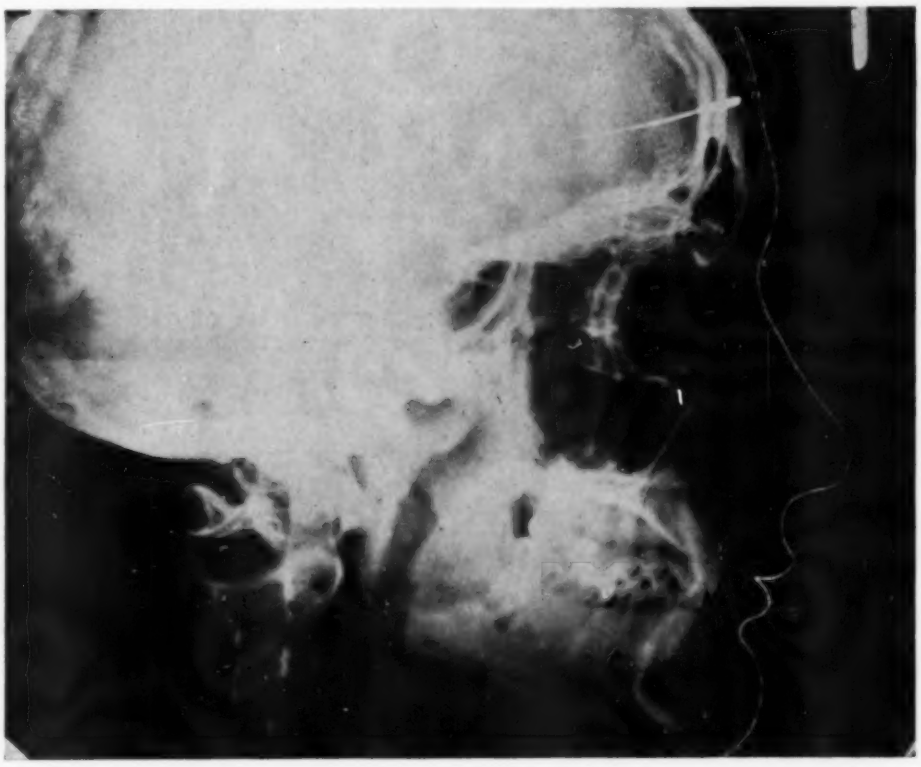


Fig. 19.—Lateral cephalometric roentgenograms of a boy aged 17½ years with congenital absence of all four third molars. His profile photographs are shown in Fig. 20.



Fig. 20.—Profile photographs of the boy shown in Fig. 19, taken when he was 10 years of age (*A*) and 17½ years (*B*). Note the underdevelopment in the lower third of his face.

loss through early extraction. The lateral x-ray record of a boy of 17½ years, shown in Fig. 19, discloses the congenital absence of the four wisdom teeth and reveals typical defects in construction of the face. His profile photograph (Fig. 20*A*) when he was 10 years of age, or soon after the third molars should appear, already disclosed the fact that he is lacking a full complement of teeth. Compare this record with that taken of him when he was 17½ years old (Fig. 20*B*). These show clearly the immature features around the mouth expressed by the failure in vertical growth between the chin and the anterior nasal spine, resulting in a deep notch below the lower lip that gives the individual a pouting expression.

Thus the long term serial records from the Bolton Study afford factual evidence proving conclusively that in proportion to the number of teeth that are congenitally absent or lost early in life, there is a profound effect on the supporting structures of the dentition and the face as a whole.

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1400 KEITH BLDG.

MAXILLARY FRACTURES

W. B. Stevenson, D.D.S., Amarillo, Texas

THE procedure in handling maxillary fractures is somewhat different from that used in mandibular fractures. Maxillary fractures are much more serious and more complicated in every way than the mandibular fracture. Any blow that will fracture the maxilla is likely to cause unconsciousness and to involve the sinuses, nose, eyes, teeth, or soft tissue, and to be accompanied by considerable shock. This condition necessitates a delay of several days before anything can be done to set the fracture, whereas most mandibular fractures can be set within a few hours after the accident.

In the meantime, while one is waiting for the patient to recover from shock, he usually can have x-rays made and prescribe sulfanilamide in 15-grain doses every four hours for average adults. By the time the patient is able to be moved to the operating room, we have a good knowledge of the condition and have made definite plans of procedure. All materials likely to be needed should be ready or available without waiting. The forces used to stabilize fractures of the maxilla are usually extraoral. In many cases a traction force is necessary. This extraoral force is best obtained by means of the plaster of Paris scullcap with coat hanger wires incorporated in the plaster. These wires are placed in such a manner that force may be exerted in any direction, or to engage a maxillary splint.

It may be well to explain the construction of the plaster skullcap for the benefit of those who have not used it.

First the hair is clipped. Then the upper part of a stocking is placed over the head, down over the tip of the ear about 1½ inches. A strip of heavy felt, 1½ inches wide, is cut to fit around the head just above the ears. This may be sewed together and then placed on the head, and the lower part of the stocking pulled up over it. We are then ready to place the wet plaster gauze over the felt base. Several thicknesses of plaster gauze are placed and the coat hanger wires are placed just in front of the ears so they will project downward; then more plaster gauze is placed. After the plaster has set, the wires may be adjusted to exert force where needed, either to engage an arch wire or dental splint. There are certain types of maxillary fractures where the intermaxillary or intraoral wiring may be used to good advantage. If the mandible is not fractured and the teeth of the opposing arches can be brought into a good occlusion, they may be wired and the jaws bandaged with a four-tail bandage. In addition to the bandage we like to use elastics which may be attached to the bandage, by means of small safety pins, on both sides at a point, or points, just in front of the tip of the ear and extend downward and forward to a point near the lower edge of the mandible. These rubbers exert a constant pull upward on the mandible which in turn will hold the fractured maxilla up in position. Without the elastics the bandage materials will soon stretch and do little good.

Read before the Southwestern Society of Orthodontists, Tulsa. March, 1943.

One definite rule to follow is to conserve bone and teeth. When one is in doubt as to whether a loose piece of bone will unite or a tooth can be saved, it is best to leave them. With the aid of the sulfa drugs we do not fear osteomyelitis as we did a few years ago, neither do we remove loose bone and teeth in the line of fracture as we once did.

With automobile accidents on the increase the maxillary fractures are becoming more common. The ratio is about one-fifth as compared to mandibular fractures, and frequently both the maxilla and the mandible are fractured. In such cases additional wires may be used to engage a chin-cap of either metal or plaster.

The care of the mouth should be such as to establish and maintain sepsis. Cleanliness in conjunction with the sulfa drugs may ward off osteomyelitis. Not long ago about 50 per cent of the jaw fractures developed osteomyelitis, but now we seldom have to deal with that dreaded complication, thanks to science.

The maxilla bounds so many cavities that it presents the following characteristics when fractured: 1. Hemorrhage may result. 2. Fractures are often compound. 3. The line of fracture is more frequently erratic and above the body of the maxilla. It may involve the nose and orbit. 4. Fetor of breath will be present where the mucous membrane is torn. 5. Ecchymosis and edema of the eyes almost always indicate fracture of the orbital ridge. In some few cases no splint or treatment is necessary while others require great ingenuity on the part of the dentist to place each fragment in its proper place and then to retain them until nature has had time to repair the break.

The open reduction method of reducing fractures and the use of various types of patented appliances all have their place when used by one especially trained, but for most of us the simpler methods are best.

918 Fisk Bldg.

DISCUSSION

Dr. Scott P. Bowyer, Tulsa, Okla.—First I want to congratulate Dr. Stevenson for having covered the subject assigned to him in a very creditable manner without going into details of various methods of reducing and stabilizing fractures of the maxilla.

Each case is one that has to be worked out for itself. What you did to a case yesterday may not apply to the case you have tomorrow, and it may be necessary to handle the new one in a very different manner.

When you have good occlusion it is well to tell the patient to keep the teeth closed tightly with pressure of the mandible on the maxilla at all times, and to support the chin with the palm of his hand all he can. If he keeps the maxilla in place for two or three days, he will not have much trouble keeping it there.

I think if there is not too much shock the fracture of the maxilla should be stabilized as soon as possible after the fracture as I feel sure we get the best results that way.

There has been so much literature in the dental magazines on facial injuries that I am sure I could not add anything to your knowledge by trying to describe in detail any of the various methods of stabilizing fractures of the maxilla.

Again I want to congratulate Doctor Stevenson on a job well done.

THE STATUS OF THE LICENSURE OF DENTAL SPECIALTIES IN MISSOURI

LEO M. SHANLEY, D.D.S., ST. LOUIS, MO.

RECENTLY there has been some discussion of the advisability of incorporating the Specialist Law in the present dental laws of Missouri.

An informal meeting was called in St. Louis which was attended by members of the Missouri State Board of Dental Examiners, the President and Secretary of the Missouri State Dental Association, and those men who are in the various specialties of dentistry in St. Louis.

Dr. T. W. Sorrels and Dr. William Flesher of Oklahoma City very kindly furnished detailed information pertaining to the Specialists Law in Oklahoma, which was presented at this meeting.

Fifty-four dentists attended this meeting and approximately fifty different opinions were expressed.

Some of those present were afraid that such a law might not be legally sound (the thought along this line being a dentist is licensed to practice dentistry in a state, and that practicing a specialty is still practicing dentistry). The likely reason for this fear is that the State Board has had a long legal fight with the dental advertisers in Missouri. The advertisers apparently had plenty of money and spent it freely in a legal effort to remain in practice. It is satisfying to report that they were brought under control by the adoption of some special amendments to our dental act.

Another opinion expressed was that the Specialists Law which was passed in one state has been a failure.

One member of the State Board of Dental Examiners felt that it would be an unwise endeavor to have this law passed without a very careful study for fear that it might cause a delay in the passage of other dental legislation which he felt was of extreme importance, special reference being made to the Traynor Bill which regulates dental laboratories.

One dentist who attended this meeting from Kansas City was of the opinion we actually did not need a Specialists Law at the present time. He did, however, qualify this statement by stating he believed some action should be taken to have the classification of specialists in dentistry in the telephone directory discontinued. It is true that in some city telephone directories one dentist will be listed as a specialist in as many as three branches of dentistry. In St. Louis we are fortunate in that such a classification is not published.

The sentiment at the meeting was that it would be unwise for a group of men who are practicing as specialists in the various fields of dentistry to endeavor to sponsor the Specialists Law without the approval of the majority of men who are doing general practice in Missouri. It was evident from the discussions at this informal meeting that many dentists knew very little in regard to the details of the proposed law.

Read before the Public Relations Forum, Southwestern Society of Orthodontists, Tulsa, Okla., March 25, 1943.

The result of this meeting was that it was decided to refer the question of having a Specialists law for the State of Missouri to the Legislative Committee of the Missouri State Dental Association, recommending that this committee report to the Executive Committee of the State Association at the annual meeting which meets in Kansas City, May 11, 1943.

At the present time information regarding the proposed law is being published in the *Missouri State Dental Journal* so that the dentists in Missouri may become sufficiently acquainted with the details of the law and the question discussed more intelligently at the State meeting. It will be impossible to have this law enacted at this session of legislature. However, with a proper educational program we hope it will be passed at the next session of the legislature.

Certainly those men in the dental profession in Oklahoma who did so much work to make the dental Specialists Law a reality in their state deserve the praise of the dental profession throughout the country. Their experience in passing this legislation, as well as the excellent manner in which it functions, has been most valuable to those states which hope to follow with similar laws.

After having made a more complete study and investigation of the points in question, we find that orthodontics is an integral part of dentistry and anyone desiring to practice orthodontics, either singularly or in combination with other branches of dentistry, first must obtain a regular dental license. The licensing system for specialists in no way interferes with the right of the dental practitioner to practice orthodontics so long as he does not publicly hold himself out as a "specialist" or as being specially qualified in any particular branch of dentistry, or as limiting his practice to any branch of dentistry. Only in the event a dentist should desire to announce or hold himself out to the public as a "specialist" is he required to supplement his regular license with one granting him this privilege. After having been granted this privilege, he continues to be a regularly recognized dental practitioner and must conform to all other regulatory requirements relating to the conduct of a dental practice.

Five states now have adopted legalized measures for licensing specialists. They are: Tennessee, Illinois, Oklahoma, Michigan, and Kansas. Naturally, some minor difficulties arose in some states, due to a lack of understanding during the time it was being set in operation. Dr. W. E. Flesher, Oklahoma City, Okla., made a cross-sectional survey of the situation, to prepare a report for the Advisory Board for Dental Specialties at the 1941 American Dental Association meeting in Houston, Texas, and according to his findings the system wherever adopted has met with general favor and all are now working satisfactorily.

Provisions for placing the specialties under licensure in the five states where such bills have been introduced and passed have no record of having aroused prejudice against any other appended amendments or separate pending dental legislation. The need for amendments for regulation of the specialties should concern us more at this time than under normal conditions, due to the rating, special training, and prestige which hundreds of dental practitioners are now receiving in the military and the U. S. Public Health dental services. When they return to civil practice, some will undoubtedly have had the necessary prerequisites in training and experience to qualify under special examination

for recognition as specialists, while many will have unwarranted opinions of themselves to support such claims properly. Without a regulatory system, it will be left up solely to the conscience of each man to determine for himself whether or not he is qualified to present himself before the profession and public as a specialist in any line of dentistry.

With three dental colleges in Missouri, many graduates acquire a license to practice in the state even though they reside in a neighboring state and obtain a license in their home state. Thus they hold an option on Missouri in choosing a location for practice. Now, with three of our bordering states, namely: Illinois, Oklahoma, and Kansas having a regulatory licensing system governing the specialties, it is only reasonable to assume that our standards should be placed on an equal basis. Otherwise, the large and heavily populated state of Missouri will as a natural sequence of events be left wide open for all dentists holding a Missouri dental license to select this state for satisfying their ambitions to become a specialist in one or more branches as they may choose. And this may be done without regard to their qualifications as they relate to the welfare of the public and the profession.

The sentiment of the conference calling for submission of the proposal to the dental profession of the state as a whole was, of course, fully justified as a matter of good business, as every dentist should be given an opportunity to familiarize himself with the law to determine for himself whether or not it is a progressive step for elevating the standards of dental practice.

7800 Maryland Avenue

THE STATUS OF THE BILL RELATING TO THE LICENSURE OF DENTAL SPECIALITIES IN KANSAS

JOHN W. RICHMOND, D.D.S., KANSAS CITY, KAN.

KANSAS acquired a new Dental Act to define and to regulate the practice of dentistry and dental hygiene during the 1943 session of the Legislature.

Section 10 of this new dental act relating to the licensure of Dental Specialties in Kansas reads as follows:

"No dentist shall announce or hold himself out to the public as a specialist, or as being specially qualified in any particular branch of dentistry, or as giving special attention to any branch of dentistry, or as limiting his practice to any branch of dentistry, unless he has complied with additional requirements established by the board, and has been issued a certificate of qualification authorizing him to do so. The board is hereby empowered to establish higher standards and additional requirements for any dentist who desires to announce or hold himself out to the public as being specially qualified in any particular branch of dentistry. The board is hereby empowered to give such examination as it may deem necessary to determine the qualifications of applicants, and may secure such assistance as the board may deem advisable in determining the qualifications of applicants. Upon application to the board by any licensed dentist in this state, the board may issue a certificate of qualification to such dentist authorizing the applicant to hold himself out, or to announce to the public, that he is specially qualified in, or limits his practice to, or gives special attention to any one of the recognized branches of dentistry. The application to the board shall be upon such form and contain such information as the board may require, and shall be accompanied by a fee, to be determined by the rules of the board, to assist in defraying the expenses in connection with the issuance of said certificates of qualifications, but said fee shall not be less than five dollars ($5) nor more than twenty-five dollars ($25). Any dentist holding a certificate of qualification under this section of the act may announce his limitation of practice by using such terms and in such manner as the board may approve together with the name of such branch of dentistry for which he is authorized to hold himself out as having special qualifications. Any dentist who shall hold himself out, or announce in any manner, by the use of any terms signifying or indicating that he limits his practice, or is specially qualified in any particular branch of dentistry, or gives special attention to any particular branch of dentistry, or shall use equivalent words or phrases to announce the same, without having obtained a certificate of qualification therefore, shall be guilty of a misdemeanor, and his license to practice dentistry shall be subject to suspension or revocation. Any announcement in the manner herein-above indicated shall be prima facie evidence that such dentist is practicing in one branch of dentistry."

Read before the Public Relations Forum, Southwestern Society of Orthodontists, Tulsa, Okla., March 25, 1943.

It should be pointed out that a clause reading as follows: "or diagnoses, makes and adjusts appliances to artificial casts of malposed teeth for treatment of the malposed teeth in the human mouth with or without instructions" was made an integral part of the section defining the practice of dentistry. The insertion of this special clause is a simple and unique method of prohibiting the commercialization of orthodontics by dental laboratories, as anyone performing such services must necessarily abide by all the provisions of the Act. To make such an attempt the individual must have a general dental license supplemented with a specialist's license in this particular branch of dentistry and abide by the anti-advertising code. Thus, it becomes plainly evident that these three requisites absolutely make such a venture a useless or impossible undertaking.

Of course, while we in the specialty of orthodontics are primarily interested in this type of legislation both for the protection of public health and for the advancement of orthodontics, nevertheless it has a far-reaching effect and benefit upon the practice of dentistry in its entirety. Henceforth, in Kansas the public at large and the profession in general will have the assurance, that those representing themselves as specialists will be more trustworthy men.

On behalf of the Kansas State Dental Association, its officers and legislative committee, I wish to take this opportunity to pay tribute to the Oklahoma State Dental Society, and its legislative committee of 1935, with Dr. Wm. E. Flesher as chairman and Dr. T. W. Sorrels as author of the section on Legal Licensure of Specialists, for pioneering in 1935 in the enactment of dental legislation relating to the licensure of Dental Specialties in Oklahoma.

The national recognition and approval given to the Oklahoma enactment, together with the success of the regulation of specialties in Oklahoma since 1935, is indeed sufficient evidence of the soundness and fundamental need of this type of dental legislation.

1008 Huron Bldg.

A METHOD OF ADJUSTING INTERMAXILLARY HOOKS ON JOHNSON TWIN ARCH

JOHN J. DOLCE, B.S., D.D.S., NEW YORK, N. Y.

TO THE majority of orthodontists, who have been using the Johnson twin-wire mechanism, one of the principal difficulties encountered has been the frequently incorrect angulation of the hooks on the arches. In the manufacture of these arches, using the prescribed vise, it has been necessary to rely almost entirely upon chance. Either one or both hooks would turn inward or outward to such a degree as to make that arch unusable as such. It was then necessary to correct the faulty hook by torquing the end tube just behind the hook. This procedure, upon mastery, has been fairly successful, but has necessitated that extra one or two steps.

Some time ago Dr. Lourie J. Porter ingeniously designed a vise which to a great degree has corrected this fault by positioning the hooks at certain angles and then drawing the end tubes away from a center fixed position.

I shall attempt to describe to the best of my ability, a "trick" which I believe is simple and quick. Dr. Johnson has approved of this and is now using it himself.

The two equal length wires which have been cut to the desired length are threaded through the end tubes in the usual manner. The length of these wires is, of course, determined by the size of the arch to be drawn.

The two or three crimps are placed in the twin wires so that the first crimp is about one-half inch from the ends of the wires. The arch is then drawn on the vise until all the crimps are well within the end tubes an equal distance. At this point the wires are bent so as to be at a right angle to the end tube (Fig. 1). If one set of crimps is drawn into the end tube before the crimps of the other side are, it is possible to fix the one side by the right angle bend, and by opening the jaws of the vise the opposite side will be drawn in until all crimps are within the end tubes an equal distance.

The arch is now removed from the vise and the hook positions are examined. The faulty hook is now corrected by simply holding it firmly in a No. 343 S.S.W. plier or between the left forefinger and thumb while the twin wires extending out of the same end tube are held in the right hand (Fig. 2). By rotating the hook in the direction of correction and the wires in the opposite direction we will then effect a repositioning of the wires within the end tube to such a degree as will correct the faulty hook. If necessary the direction of the hook can be exaggerated in one direction or the other. By this method the hook can be changed on one side or both (Fig. 3).

After having properly placed the hooks on the arch as may be desired, the loose ends are cut off and polished down smooth.

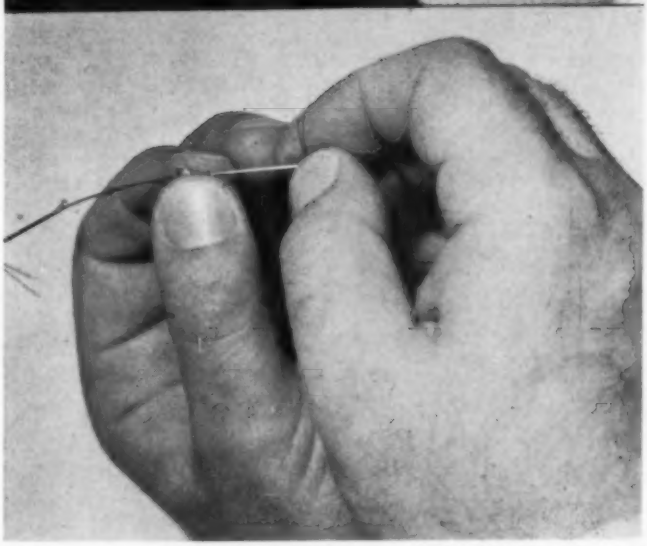
Fig. 1.



Fig. 2.



Fig. 3.



This trick in no way perfects the Johnson twin-wire arch but makes the best appliance a little better and simpler to handle.

2922 Grand Concourse

JOHNSON TWIN-WIRE ARCH PROGRESSIVE CLINIC

I. Johnson Technique of Anterior and Molar Band Making (Demonstrated on Manikin). Henry U. Barber, Jr., D.D.S.

II. Adjustment of Molar Buccal Tubes for the Johnson Twin-Wire Mechanism. Joseph D. Eby, D.D.S.

III. Johnson Twin-Arch Technique and Special Arch Pulling Vise. Lowrie J. Porter, D.D.S.

IV. Coil Spring Attachment to Johnson Twin-Wire Appliance. Clare K. Madden, D.D.S.

This progressive clinic consisted of four technical clinics given in compliment to Dr. Joseph E. Johnson of Louisville, Ky., who, in the opinions of the clinicians, has made a most worthy contribution to the progress and science of orthodontics.

Following the technical clinics Dr. Johnson gave a color lantern slide lecture on the use of the twin arch in the treatment of various types of cases. He also showed the method of seating and unseating the twin-arch locks and the adjustment of the arch with and without coil springs.

Dr. Johnson's lectures were fully described and illustrated in three publications of the American Journal of Orthodontics and Oral Surgery (Volume 27—April, June, and July, 1941) and, consequently, are not repeated in this progressive clinic report.

The aim of the clinicians of this group was based on a desire to assist in the teachings of the technique of Dr. Johnson, not with the idea of creating any new devices or technique, but rather to so coordinate the various progressive steps in the Johnson technique that it could be readily followed by those who might not have had the opportunity of studying directly under the teachings of Dr. Johnson.

Although no changes were made in the twin-arch technique, the clinicians demonstrated some such auxiliaries as had proved of value in simplification or in speed of construction in the various steps or procedures of the twin-arch technique.

I. JOHNSON TECHNIQUE OF ANTERIOR AND MOLAR BAND MAKING

Henry U. Barber, Jr., D.D.S., New York, N. Y.

In demonstrating the positioning and adaptation of the Johnson twin-wire mechanism, this section of the progressive clinic deals with:

1. The allocation of anterior and posterior bands.

2. The method of adapting them and instruments used. It is an accepted fact that any appliance, in order to reach its maximum efficiency, must be placed on the teeth in a precise predetermined position. Bearing this in mind we will proceed with the adaptation of the anterior bands.

Presented before the First Inter-American Orthodontic Congress and the American Association of Orthodontists, New Orleans, La., March, 1942.

Ranging from No. 1, small, to No. 4, large, these bands are 3/32 inch wide and 0.005 inch in thickness. To those of you who have used wider bands, these will appear very narrow, but you may rest assured they are most efficient.

Beginning with a maxillary central incisor, select a band, usually No. 4, and before placing it on the tooth, crimp both incisal and gingival edges with preferably a No. 136 S. S. W. plier as shown in Fig. 1. This step will procure a snugly fitting band at the edges. Place on the tooth so that it is adjacent to but not impinging on the septal tissues, adjusting it so that the lock is at right angles to the long axis of the tooth and in the center of the tooth mesiodistally. On a rotated tooth, place the lock in such a position that it is farther away from the arch when the arch is in position. Locks with rotating holes can be bought for this purpose. Placing the thumbnail in the lock as a means of holding the band in its correct position, as in Fig. 2, insert the Johnson modified rubber dam clamp forcep so that the short beak rests against the lingual incisal surface of the



Fig. 1.

tooth and the long hooked beak into the loop in the band. Compress the handles until the band fits snugly around the tooth and a loop forms on the lingual surface. Remove the forming plier and with a Howe plier, pinch this loop tightly together (Fig. 3). Burnish the band to the lingual surface with the plier or suitable burnisher and before removing, measure the distance between the incisal aspect of the band and the incisal of the tooth, as in Fig. 4. Transfer this measurement to the opposite central incisor and mark with a fine-pointed, hard lead pencil. When banding the maxillary lateral incisors, decrease this measurement one millimeter and mark these teeth as before. This will assure proper relationship and alignment of all four teeth at completion. One must make sure that ample separation of the teeth has been accomplished prior to the fitting of all bands.

The Johnson molar loop band is made of 0.008 material and is 0.18 inch wide. By using this width material it is seldom necessary to festoon the band

when adapting to the tooth. These bands are already annealed when they come to you and are made in four convenient sizes. When banding a molar tooth, select a band which will have to be opened slightly to slip over the tooth. This opening can be accomplished readily with the fingers. Place the band on the tooth so that the loop is in the center of the mesiobuccal cusp and the gingival edge is about one millimeter under the margin of the gum. (See Fig. 5.) With



Fig. 2.



Fig. 3

a band adapter or similar instrument, press the band into all embrasures around the occlusal edge of the band. Now with the Johnson loop band pinching plier—curved beak for the upper and straight beak for the lower—pinch the loop tightly together, thus adapting the band snugly around the tooth. This is shown in Fig. 6.

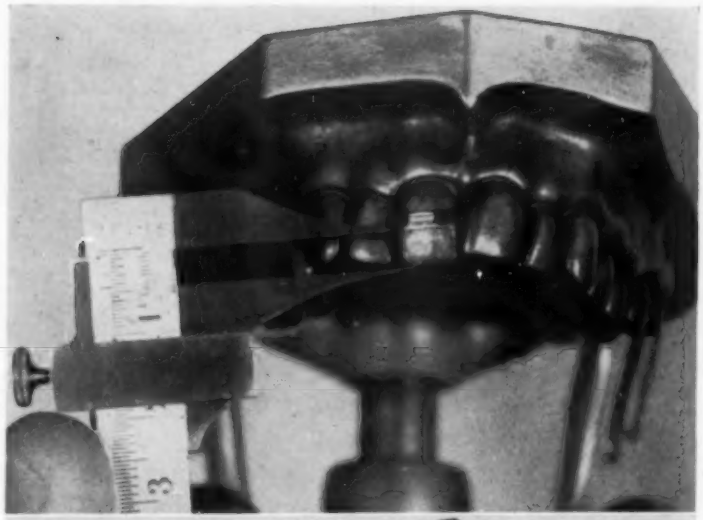


Fig. 4.

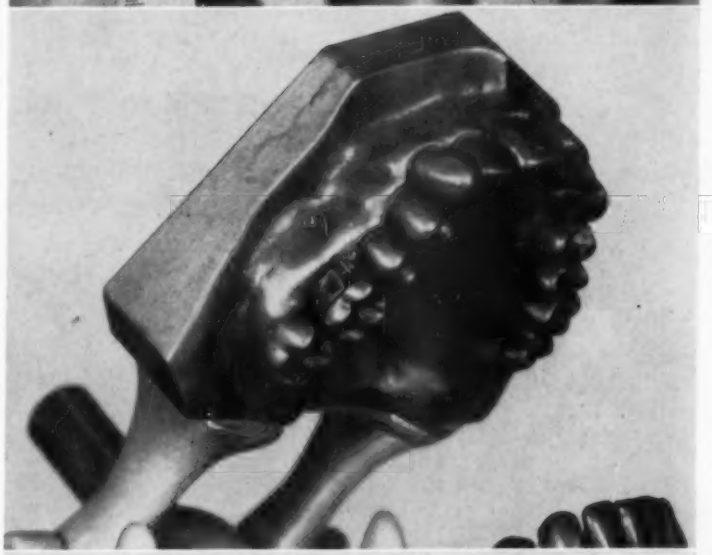


Fig. 5.

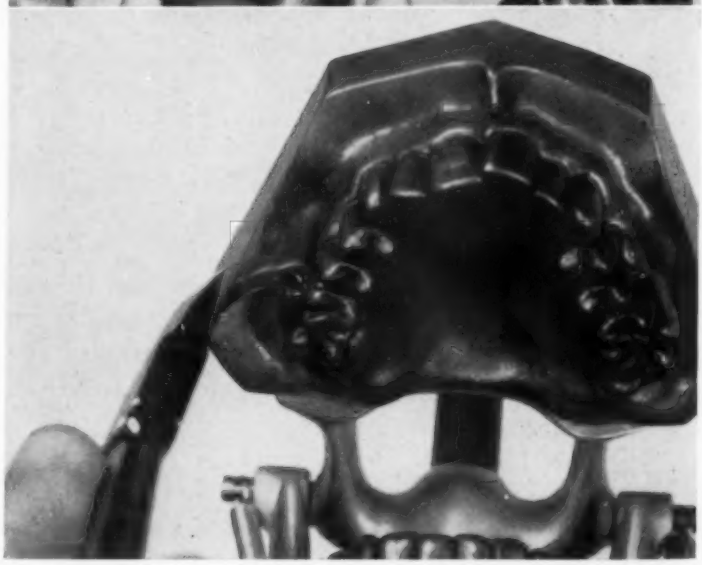


Fig. 6

We are now ready for the next step in the technique before removing the band, and this will be demonstrated in the clinic to follow.

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II. ADJUSTMENT OF MOLAR BUCCAL TUBES FOR THE JOHNSON TWIN-WIRE MECHANISM

JOSEPH D. EBY, D.D.S., NEW YORK, N. Y.

Inaccuracies in the positions of buccal tubes may seriously alter or even destroy the purposes and effectiveness of the twin-wire mechanism. Buccal tubes on molar bands should occupy a definite relation to the attachments on the anterior bands. They should all lie precisely in the same plane, if tooth alignment is the principal object.

If anterior teeth are to be elongated or depressed, the positions of the buccal tubes should be set at an angle so as to direct the position of the twin-wire segment in the desired relation to the anterior bands.

Buccal tubes may be only slightly displaced up or down, in or out, sufficiently to defeat the purposes required. This is particularly true when spiral coils are to be used on the tubular end pieces and traction should be free and unobstructed as when friction is caused by malalignment of tubes.

Waxing Molar Bands (Fig. 1).—If molar bands are removed from the mouth in an impression, apply a drop of pink paraffin wax, melted on a small spatula, to the inner buccal surfaces before pouring the model. Upon soldering this wax will burn out and leave an open space between the buccal surface of the band and the model.

Not having to heat so much of the model requires less heat, a more uniform distribution of heat between the band and the buccal tube, less solder and a fine attachment. Model is to be poured preferably in stone and allowed to dry, if time will permit.

Marking Six Anterior Teeth (Fig. 2).—With a sharp pointed pencil, lines are first drawn through the center of each anterior tooth from the cutting edges to the cervical margin of the gum. These lines are continued directly up the long axis of the root of each tooth, regardless of their relation to each other. Transverse lines are then drawn across the teeth at right angles to the axial lines and at the position on the labial surfaces where the slots on the anterior bands are to be fitted. Each anterior tooth to be banded is marked this way, regardless of the relation of the marks to those on the adjacent teeth.

Preliminary Waxing of Buccal Tubes (Fig. 3).—The buccal tubes should be seamless, thick walled, 0.25 inch in length and 0.036 inch inside diameter. Each buccal tube is slipped over a piece of 0.036 steel or tungsten wire about two inches in length. The tube is placed across the buccal surface of the molar band with the supporting rod pointing in the general direction of the transverse markings on the anterior teeth.

Accurate Adjustment of Buccal Tubes (Figs. 4 and 5).—The steel or tungsten rods are then removed from the buccal tubes which will be held in position on the bands by the sticky wax. A dummy twin arch is then inserted into the waxed or buccal tubes. By grasping the tubes over the sticky wax the arch may be adjusted to the exact position along the lines marked on the anterior teeth to give the arch the position its needs will require (Fig. 5).

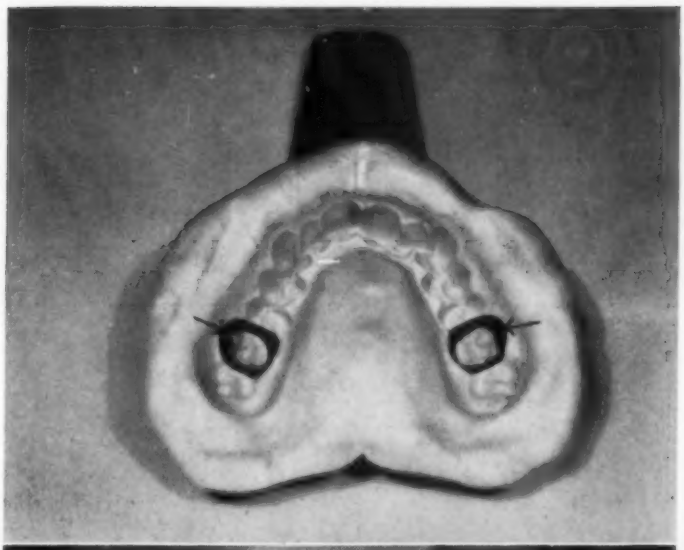


Fig. 1.

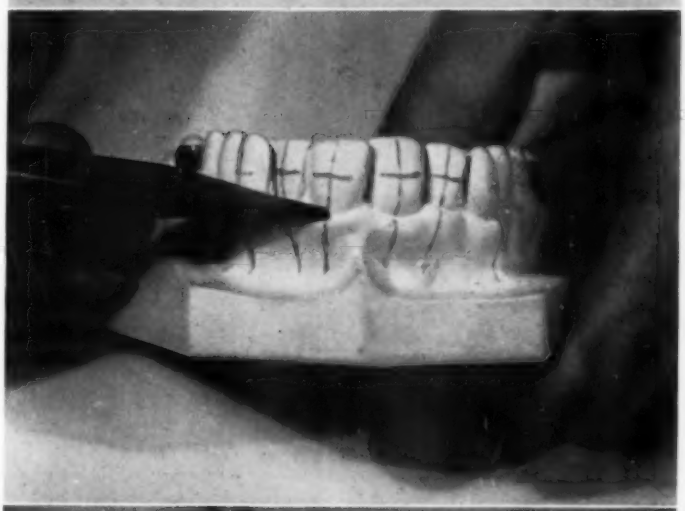


Fig. 2.

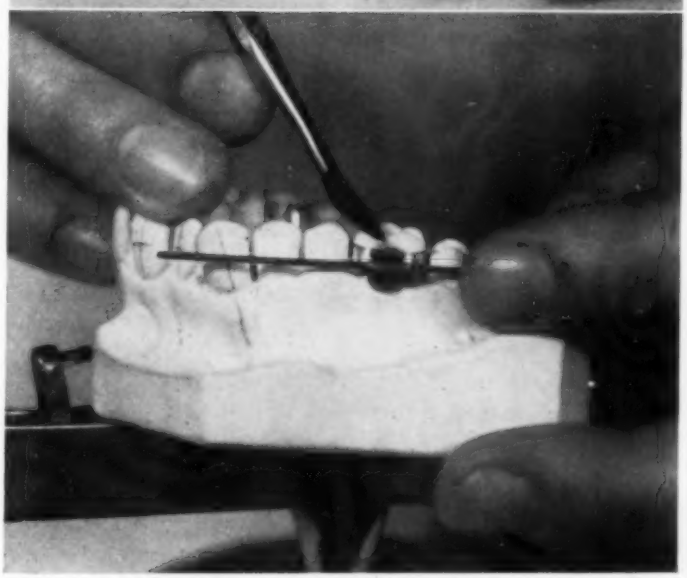


Fig. 3.

Soldering Buccal Tubes (Fig. 6).—Remove dummy twin-wire arch and replace the steel or tungsten rods in the finely adjusted tubes. The rods can then be fastened to the sides of the model with a very small amount of soft plaster applied over the region of the premolar teeth. The sticky wax can now be burned off the tubes so they will shift loosely on the rods. The tubes may then be run forward or backward on the rods in order to adjust the exact position they should occupy in relation to the band and the overlying soft tissues (Fig. 7). The tubes may now be soldered to the bands with a fine and delicate solder joint.

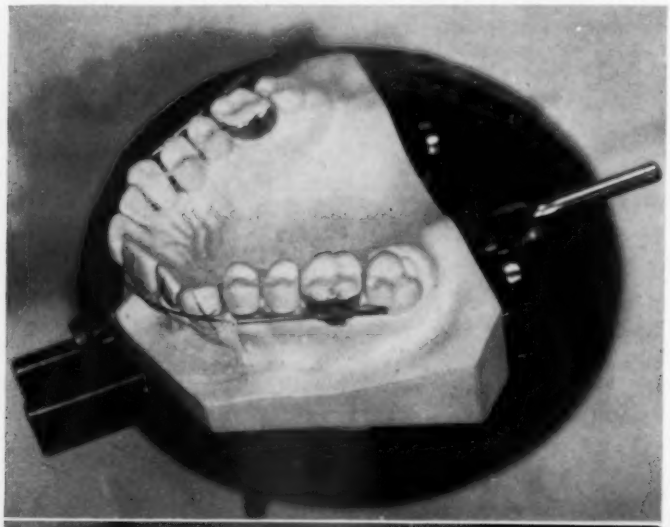


Fig. 4.



Fig. 5.

Measuring for the Construction of Twin Arches (Fig. 8).—Remove the small bits of plaster attaching the supporting rods to the model and slip them out of the buccal tubes now soldered to the bands. With pencil, mark again on model the points for the location of the front ends of the tubular end pieces. The lengths of the end pieces can then be measured from these marks to the posterior ends of the buccal tubes.

A measurement with a flexible steel ruler can then be taken across the labial surfaces of the anterior teeth between the locations marked for the front

ends of the buccal end pieces in order to determine the length of the twin-wire segment.

The next step would be the construction of the twin-wire arch itself.



Fig. 6.

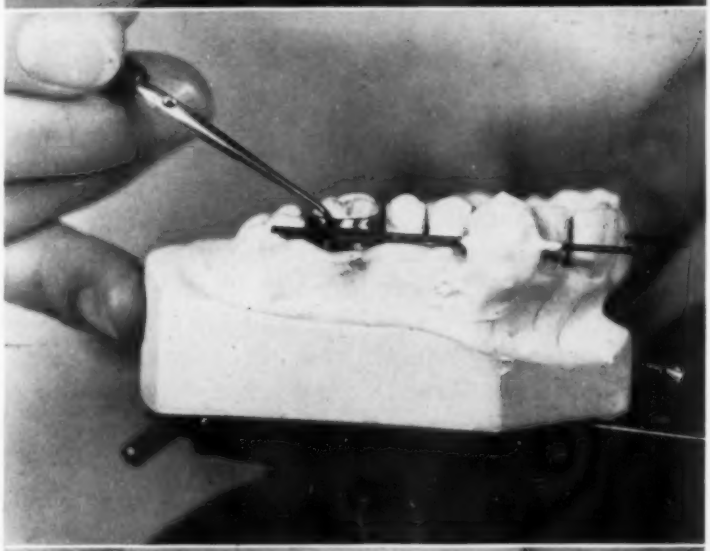


Fig. 7.

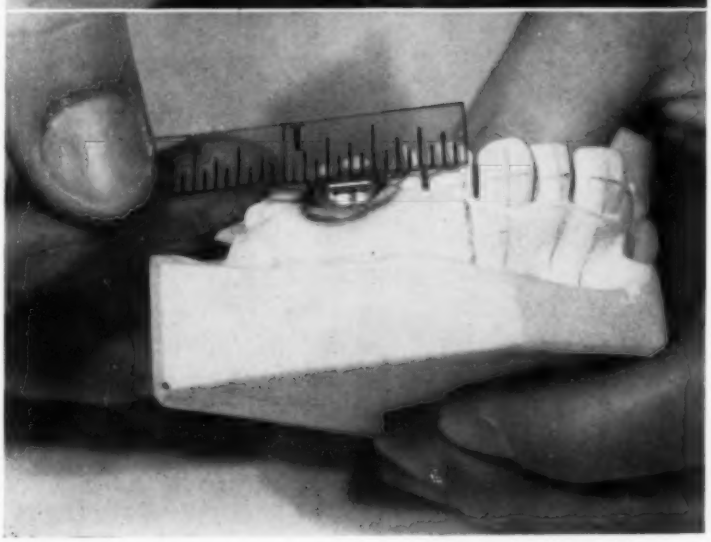


Fig. 8.

III. JOHNSON TWIN-ARCH TECHNIQUE AND SPECIAL ARCH PULLING VISE

LOWRIE J. PORTER, D.D.S., NEW YORK, N. Y.

Various types of gadgets which have proved useful in the assembly and use of the Johnson twin arches are demonstrated in this clinic.

Fig. 1, *A*, shows a jig for cutting buccal tubes. This jig should be fastened in a vise. Johnson tubing is run into a longer tubing (.040 I.D.) as shown. The large tubing on the left end is cut 1⅛ inches long, acting as a gauge for the cutting of the Johnson tubes. At the left end of this tubing is a flat spring which acts as a stop while the Johnson tubing is being cut as shown by knife-edge stone. The Johnson tubing continues to be fed in after each tube cutting which automatically pushes out the tube which has been cut. (Spring releases sufficiently to allow this.) Many tubes can be cut accurately and in a very short time.

The next step in assembly is the cutting of twin wires as shown in Fig. 1, *B*. These wires are cut 3¼ inches long on a wire cutting jig, shown in Fig. 2. The spool shown on the post is a silk ligature spool trimmed down to make the circumference 6½ inches. Two slots have been cut, as shown on opposite sides of the spool, in order that scissors may be inserted at this point to cut the wire. The knob serves as a handle for winding wire from the large spool. When sufficient wire has been wound, two rubber bands are placed crosswise as shown to keep the wires from being displaced when the wire is cut in the slots by a pair of scissors. This will quickly give many wires cut accurately at 3¼ inches in length. The illustration shows how the wires are held in place after they have been cut. This device is also used for cutting ligature wires to be used at the operating chair.

The next step consists of threading the tubes with the twin wires. We have found two twin wires to work better for us than the looped wire which is generally used. It saves bending it back on itself, and we also believe it pulls through the tubes more accurately.

The twin wires are now crimped as shown in Fig. 1, *C*. It is essential that both of these crimps should be in the same direction. That is, parallel to each other.

The arch is now placed in the vise designed for this purpose.

This vise (Fig. 3) is designed with a right and a left hand thread so that the end blocks pull away from each other and away from the stationary center block to any desired distance. The center section with the thumbscrew grips the twin wires in the center holding them firmly while the tubes are pulled along the twin wires as shown.

By carefully threading the wires through the tubes and crimping them together, there should not be the difficulty of having the anterior twin sectional

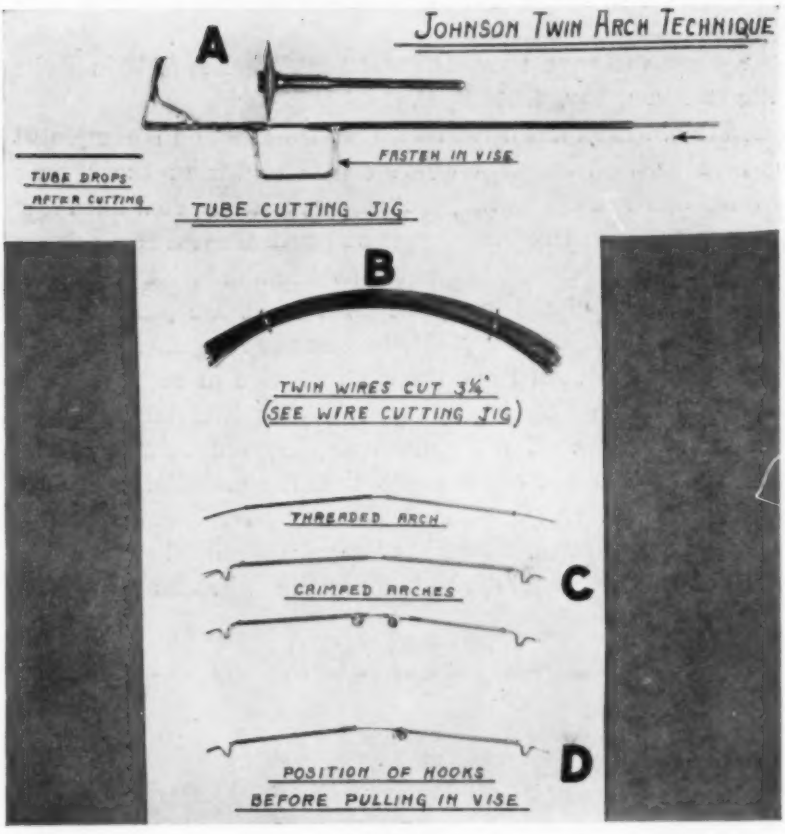


Fig. 1.

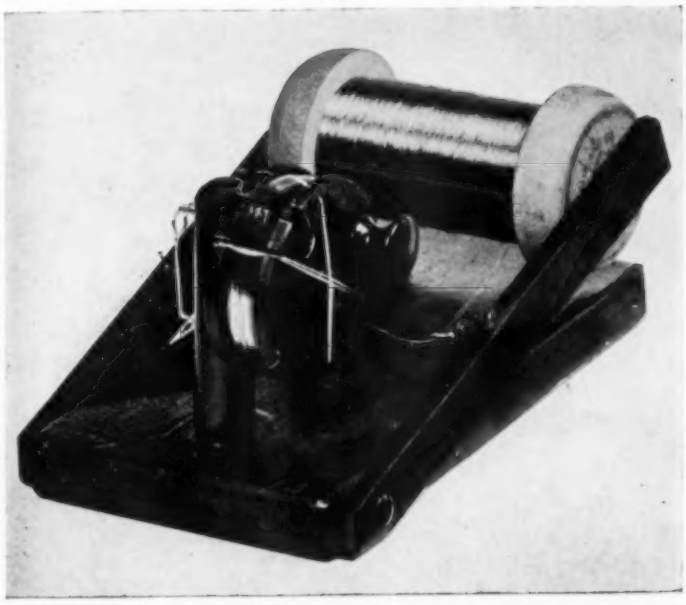


Fig. 2. (From Porter: Am. J. Orthodontics and Oral Surg. 27: 577, 1941.)

wires crossed after the arch is pulled. Any size arch may be pulled as indicated on the graduated scale.

It is our custom to have a stock of seven varied sizes of twin arches numbering from one to seven, Fig. 4, *A*, *B*, *C*.

The number one arch has a twin wire anterior section measuring 1⅜ inches. Each successive arch increases a quarter of an inch in the anterior section, making arch number two 1⅝ inches, the next, 1⅞ inches, etc., until number seven arch is 2⅞ inches. It will be found that numbers six and seven are very rarely used and could easily be eliminated so far as stocking is concerned.

By the use of this vise, Fig. 3, the twin wires are pulled into both tubes exactly the same distance. Since the twin wires are 3¼ inches long, a twin section pulled 1¼ inches would leave one inch of wire in each tube. Making the size of the twin section longer results in leaving that much less wire in the tubes. Cutting the tubes off will not cause the twin wires to slip out of the tubes unless the tube is cut off so much that the crimped section of the wire in the tubes is cut off. As a general rule not over three-eighths of an inch will be cut off of a tube made 1⅛ inches long. If a looped wire is used, the loop may be easily cut off by mistake, resulting in the twin wires slipping out of the tubing.

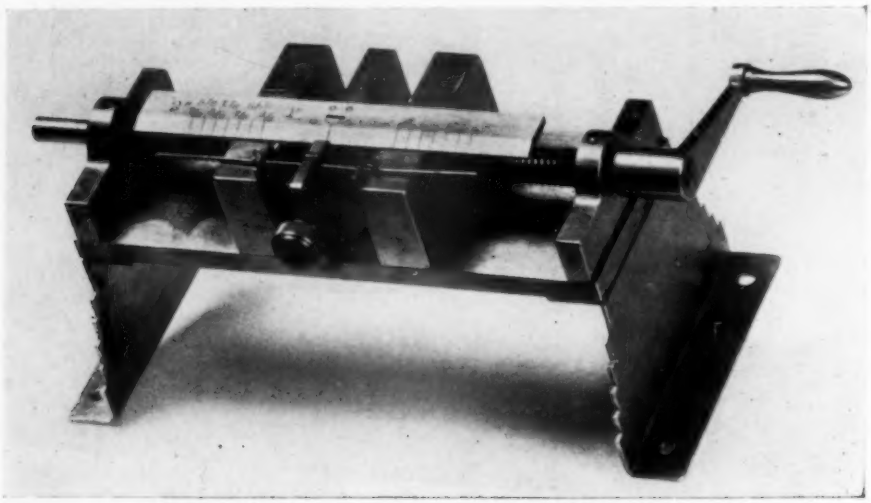


Fig. 3. (From Porter: Am. J. Orthodontics and Oral Surg. 27: 577, 1941.)

One of the greatest advantages of this vise is that the position of the intermaxillary hooks can be controlled. The twin wires should be placed in the vise with the crimps pointing forward in a horizontal position as shown in Fig. 1, *C*. The left hook should be placed a little back from an upright position and the right hook a little forward from the upright position. (See Fig. 1, *C*, and also as placed in vise in Fig. 3.) I do not understand just why this position makes the hook pull into the right position in the finished arch, but for some unknown reason it seems to work out that way.

If one hook should be slightly out of the correct position the hook can be turned by twisting the arch in the hands. This cannot be done when a recurved wire is used in place of pulling two single wires as shown. The vise shown in Fig. 3 allows this control of the positioning of the buccal tubes.

Fig. 5 shows the method of measuring for the selection of twin arches to be used. Pieces of silk ligature about eight inches long are cut and a loop is tied in one end. Such pieces are kept in the dental cabinet ready for immediate use. By looping one end over one of the buccal tubes on the molar band, the ligature is held in place and drawn around to the buccal tube on the opposite side of the mouth. A skin or eyebrow pencil is used to mark on the string the mesial ends of the molar buccal tubes. Marks are then placed on the string at the position which is desired for the beginning of the anterior twin wire section. These marks will usually be in about the cuspid position.

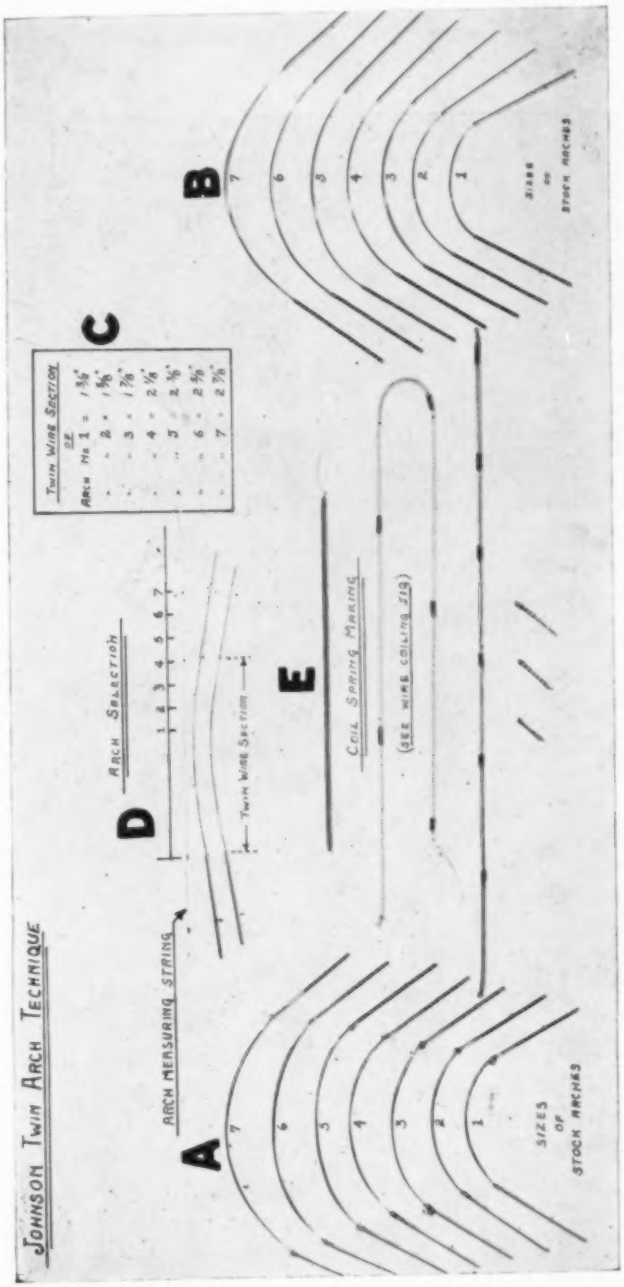


Fig. 4. (From Porter: Am. J. Orthodontics and Oral Surg. 27: 577, 1941.)

The string is now taken from the mouth and given to the chair assistant who selects the desired size of arch. The string will appear as shown in Fig. 4, *D*. The two center black marks give the size of the anterior twin section and the two outer black marks indicate the position of the anterior end of the molar band buccal tubes in the patient's mouth. The Johnson side tubes are then cut a quarter of an inch beyond the outer marks. This gives a quarter of an inch of tubing to slide into the molar buccal tubes. This method allows an easy selection of one of the stock twin arches and also gives a definite measurement for the cutting of the end tubes. It eliminates all necessity for trials of the arch in the mouth, for additional lengthening of arches, and fittings for the cutting of the end tubes. We have found this method to be very efficient and a great time saver.



Fig. 5. (From Porter: Am. J. Orthodontics and Oral Surg. 27: 577, 1941.)

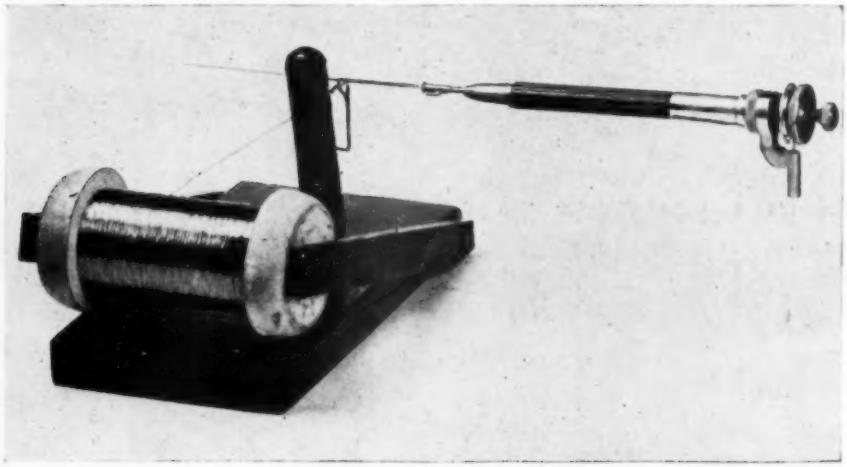


Fig. 6. (From Porter: Am. J. Orthodontics and Oral Surg. 27: 577, 1941.)

Fig. 6 shows the method of making coil springs. The same device as shown in Fig. 2 is used, except that the wire cutting spool has been removed. A piece of tubing (about 0.038) is run through the post parallel to the long axis of the large spool. Soldered at right angles to that tubing is another piece of tubing through which the hard-drawn wire is run.

An 0.032 wire is soldered to a hand-piece mandrel as shown. On one side of the mandrel is soldered a short piece of 0.020 tubing (approximately).

The 0.032 wire from the mandrel is now run through the tubing in the post. The hard-drawn wire for coil spring making is run through the forward tubing and the end of the hard-drawn wire run through the small 0.020 tube on the side of the mandrel. This will hold the wire when starting to coil the spring and will allow an easy release of the spring after it has been coiled, as the end of the hard-drawn wire then merely slides out of the 0.020 tube.

The dental engine turns the 0.032 wire winding the hard-drawn wire accurately and quickly into a coil. The forward tube controls the position of the hard-drawn wire regardless of where it may be coming from the large spool. The 0.032 wire gradually comes out of the post tubing as the coil is being spun. The tube in the post steadies the 0.032 wire so it does not bend, and also the operator does not have to hold the coil in the fingers, as this process becomes very warm if held in the fingers while spinning a coil.



Fig. 7. (From Porter: Am. J. Orthodontics and Oral Surg. 27: 577, 1941.)

When the coil comes to the end of the 0.032 wire it will automatically break off, and if the forward tube is small enough, the kink made when the wire breaks will catch on the end of the tube and prevent the wire on the large spool from uncoiling. The side pieces holding the spool should have some tension to keep the spool from unwinding too rapidly. Round head screws on the inside of the side pieces rest in the holes on the end of the spool. Making the side pieces of thin hard wood will allow them to be sprung sidewise sufficiently for changing spools.

While coiling a spring it is best to hold the spool with the hand to add tension. This will give a very tightly wound coil.

The coil is then stretched as shown in Fig. 4, *E* (U-shaped section). It should be pulled out leaving intermittent sections of tightly wound coil as shown. The stretched coil is then replaced on the 0.032 wire and tightly compressed. This will give a coil as shown. This piece is then cut into small coils of the desired length to use. One end of each coil should be left tightly wound for about a sixteenth of an inch. This tight section will fit closer to the arch tubing and

will allow the springs to be stopped at the desired position on the tubing by pinching the tubing as has been demonstrated by Dr. Johnson.

The vise shown in Fig. 3 is made on order by the H. Wibling Tool & Mfg. Co., of 116 Walker Street, New York City.

Fig. 7 shows the pliers used for making the crimps in the twin wires.

ADDENDUM

Since this clinic was given, Dr. John C. Dolce of New York City during his association with Dr. Ashley Howes of New Rochelle, N. Y., discovered a very simple method of twisting the Johnson buccal tubes into correct positions on the twin-wire arches. If the twin wires are cut sufficiently long to allow an extension of the twin wires beyond the distal ends of the buccal tubes after the arch is pulled, the extended twin wires can then be bent at right angles to the buccal tubes. By grasping these ends firmly, the twin wires can be twisted in the tubes until the intermaxillary hook has been rotated to the desired position. In many instances this will also straighten out any twisting of the wires in the anterior section of the twin arch. Dr. Dolce has developed a technique which will greatly simplify a perplexing problem in the twin arch construction.

41 East 57th Street

IV. COIL SPRING ATTACHMENT TO JOHNSON TWIN-WIRE APPLIANCE

CLARE K. MADDEN, D.D.S., GREENWICH, CONN.

Size of Coil Spring.—One of the few auxiliary accessories used with the Johnson twin-wire appliance is the coil spring. It has been found effective in opening and closing spaces on the mid-section and for movement of molars on the end tubes.

The end tube coil springs are made by wrapping a 0.009 inch hard stainless 8-18 wire on a 0.032 inch core wire. The core is held in a pin vise mandrel and then placed in the handpiece of the dental engine.

Spring Pressure.—For those not familiar with the forces of coil springs, it is advisable to use a ½ inch of the coil on the end tubes. If the coil spring is compressed 1/32 inch, it will exert a force of 1½ ounces. This is the amount of adjustment advisable when the spring is put into action against the buccal molar band tube.

At the end of two weeks, the spring is again compressed 1/32 inch making a total adjustment of 1/16 inch which will exert a 3-ounce force—an adequate force to move a molar. If intermaxillary rubbers that exert a force of five ounces are used with the 3-ounce coil spring force, there will be no tendency for the twin arch to move the anterior teeth labially. At each appointment the spring can be compressed another 1/32 inch until the molar is moved the desired distance.

Coil Springs on Mid-Section.—The technique for making the coil springs for the mid-section is the same as for making those for the end tubes. The wire used is 0.0056 inch hard stainless steel wire alloy 8-18. It is wrapped on a 0.020 inch core. Before the twin arch is assembled, two ¼ inch and three 1/16 inch lengths of coil spring are threaded over the twin wires. The end tubes are then slipped over the twin wires and the arch assembled by pulling in the vise. It has been found that a ¼ inch length of the anterior springs will exert a force of 2½ ounces if the spring is compressed 1/32 inch. When compressed 1/16 inch it will exert a pressure of five ounces. The 1/16 inch coils are threaded on so as to have them available to add to the ¼ inch coils when additional force is needed.

When maxillary molars are being moved distally by coil springs on the end tubes, it is advisable also to have anterior coil springs between the intermaxillary hooks and the locks on the lateral incisors. This will prevent the anterior teeth from sliding on the twin wires and becoming separated.

Threading of Posterior Coil Springs on Mid-Section.—If a section of coil spring is needed and one does not wish to remove the plain twin arch, a length of the posterior coil spring can be threaded on the mid-section.

Soldering of Stationary Intermaxillary Hooks.—Fig. 1 shows a jig which can be used in the soldering of the intermaxillary hook to the end tube. It is

important to see that the flux and 18 carat solder encircle the tubing before attempting to solder the pressure metal 0.020 inch wire which is shaped into a hook.

Sliding Hooks to Rest Against Buccal Coil Springs.—An intermaxillary hook can be soldered to a precious metal tube which will slide on the end tube and exert pressure against the coil spring. In using this accessory one is assured that there will be no force to produce an undesired labial movement of the maxillary anterior teeth.

Cutting of End Tubes to Fit Case Accurately.—Before placing the caps on the anterior bands and locking the twin arch in place, it is most important to note the length of the end tubes. If the end tube extends through the buccal tube, it will irritate the cheek tissue.

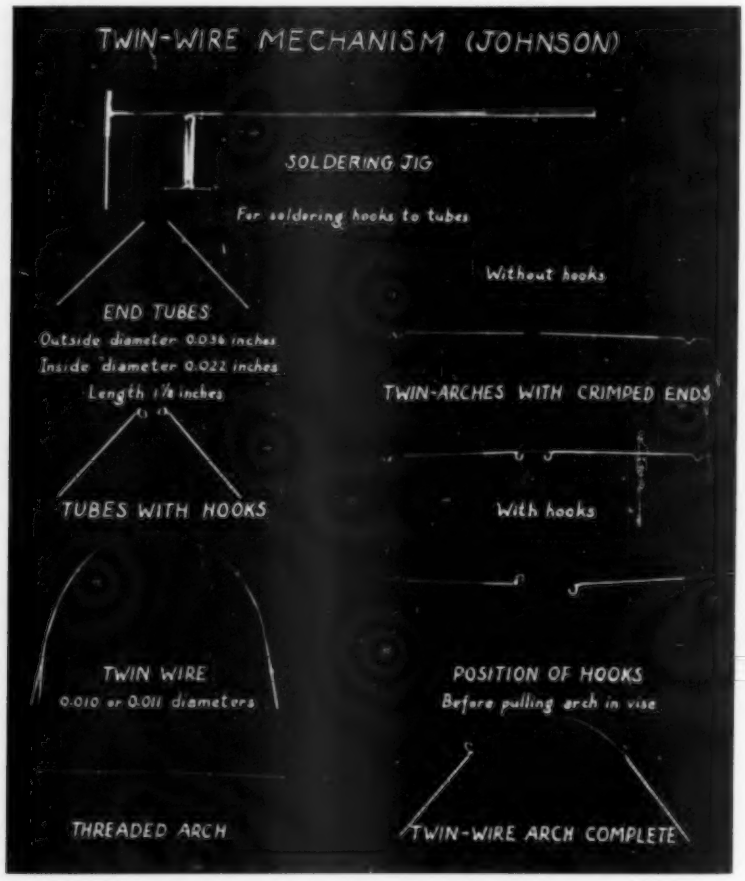


Fig. 1. (From Madden: Am. J. Orthodontics and Oral Surg. 28: 449, 1942.)

Making Single Wire Arch for Starting Some Cases.—Many times at the beginning of treatment it is not advisable or possible to seat the twin wires in the locks because of the irregularity of the teeth. When this occurs a wire ligature is passed through the lock and ligated to the twin arch, and the tooth is moved by this method until the wire can be engaged in the lock.

Many times it is possible to place one wire in the lock and by this means exert a more gentle force until the tooth can be brought more nearly into alignment so that both wires can be engaged.

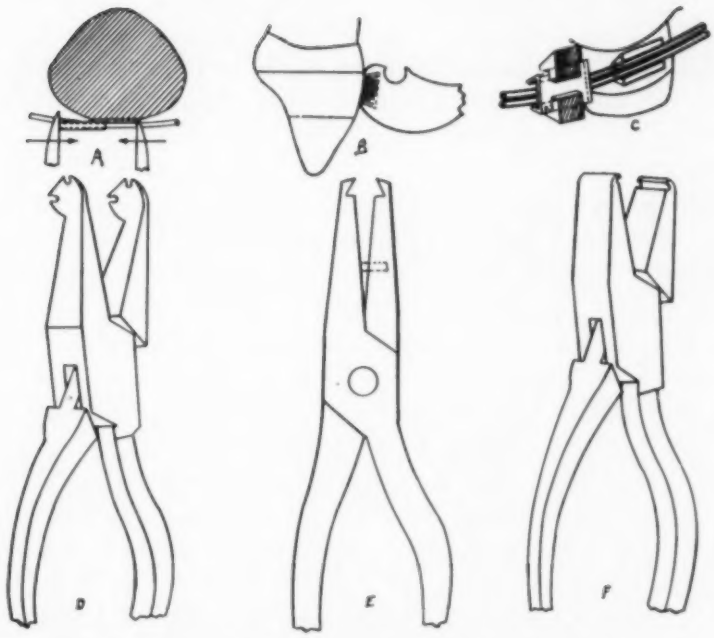


Fig. 2. (From Johnson: Am. J. Orthodontics and Oral Surg. 27: 202, 1941.)

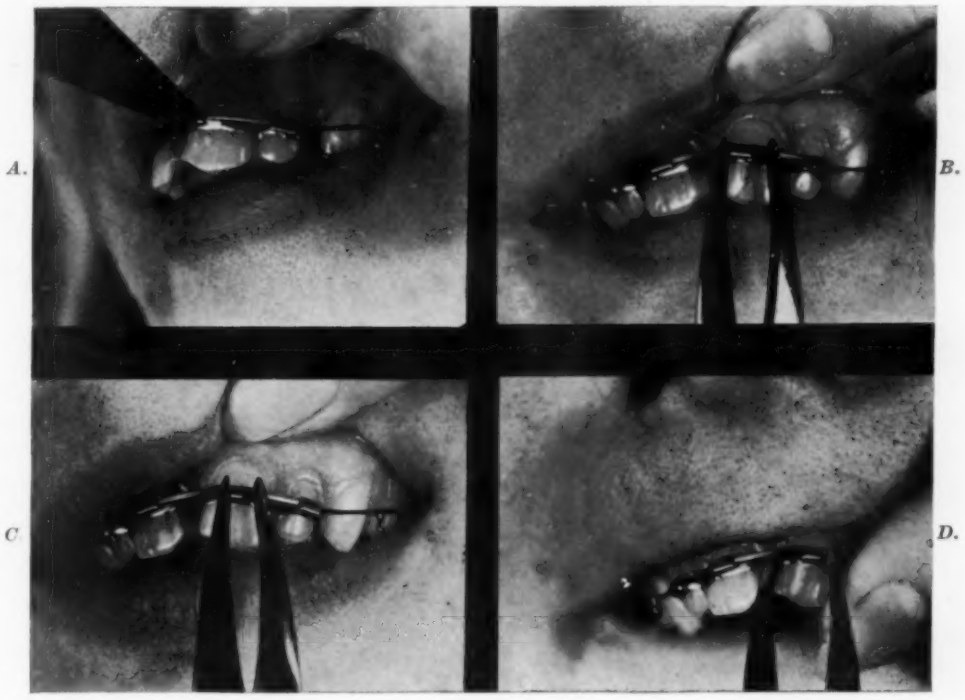


Fig. 3. (From Johnson: Am. J. Orthodontics and Oral Surg. 27: 202, 1941.)

Bending or Pinching Tubes to Prevent Cheek Irritation.—The mesial end of the end tubes should be bent lingually so as to prevent irritation of the lip.

Placing of Arches and Seating of Locks.—In placing the arch it is necessary to observe the position of the buccal tubes as well as the position of the anterior bands. The twin arch will automatically lengthen or depress teeth depending on its position.

In seating of locks or caps (Figs. 2 and 3) I quote from Dr. Johnson's article which appeared on pages 207 and 208, with Figs. 8 and 9, in the April, 1941, issue of AMERICAN JOURNAL OF ORTHODONTICS AND ORAL SURGERY.

"Two pliers, *D* and *E*, Fig. 2, are used to seat the cap. The E-plier, called placing plier, is used to pick up the cap or female part and start it over the male attachment, Fig. 3*A*. The E-plier is furnished with a stop which permits a slight tightening of the cap. If trouble is experienced with the caps coming off, grind down the stop until the caps fit more snugly; then they will not come off. The D-plier, called seating plier, is used to complete the seating of the lock. It has two grooves in the beaks, one for maxillary and the other for mandibular teeth. The grooves fit over the twin wires and force them into the seat of the male part, and at the same time the beaks are closed, which completes the seating of the cap, as in Fig. 3*B* and *C*. To remove the lock, one beak of seating plier is placed against the side of the tooth while the other beak rests against the corner of the lock; then by closing the beaks of the plier, the cap is forced off as is shown in Fig. 3*D*."

22 LAFAYETTE PLACE

Editorials

The Bolton Study

Factual evidence collected by the Bolton study for the past 14 years would acquit the wisdom teeth of the "fifth column" charges and include them along with the incisors as cosufferers resulting from the failure of the facial skeleton to attain its complete adult size and proportions.

The above statement is included in the article published in this issue, "The Influence of the Third Molars on the Alignment of the Teeth," by B. Holly Broadbent, director of the Charles Bingham Bolton Fund in the Department of Anatomy, School of Medicine, Western Reserve University, and which was read before the Inter-American Orthodontic Congress in New Orleans in March, 1942. The quotation will interest orthodontists of experience. If you are one of those who has observed a beautifully corrected case collapse in the anterior part of the lower arch at the age of adolescence; if you are one who has watched with anxiety and anguish the overlapping of the mandibular incisor teeth after you have placed them in satisfactory alignment and, in casting about for a cause, you have x-rayed the third molar and found it tipped at a sharp angle toward the mesial, and have explained, "there's the guilty culprit; the wisdom tooth is impacted"; if you have reasoned that the answer to the problem is to extract both of the wisdom teeth, then you will be interested in carefully reading and studying the illustrations in the Broadbent paper, so that you may mentally check the evidence revealed with your own clinical experience.

It was the late Dr. George B. Winter, the last twenty years of whose life radiated closely about the focal point of the mandibular third molar, who was able to write an entire textbook about this one tooth and who made the observation that orthodontic appliances carelessly handled sometimes are responsible for the impaction of third molars. Upon being asked to elaborate on this opinion, he explained that a Baker anchorage used in Class III in childhood applies distal pressure over a period of months to the third molar, which is only partly formed and that this pressure, if applied too long and directly, causes dislocation of the tooth and capsule. In Class II, he explained the Baker anchorage applies pressure vice versa to the upper third molar.

Dr. B. Holly Broadbent, in correspondence, states that additional clinical material which has been collected during the past fifteen years on aberrant canines and molars fully confirms the above observations regarding the undesirable effect of certain types of orthodontic activity, and, that he is rapidly completing the preparation of this material for publication.

There are orthodontists who have observed in clinical experience the impaction of the maxillary canines as a result of too vigorous a pressure applied to the maxillary anterior teeth in the treatment of Class II, division 1 cases

in young children. It is with a great deal of interest that scientific data are being prepared and published that reflect carefully assembled material upon this interesting subject. In the words of the late Dr. Winter (who incidentally took special training in orthodontics many years ago), "When a Baker anchorage is applied to a dental arch twenty-four hours per day, month after month, things happen, and if you would know what happens instead of guessing, check your cases from time to time, with the x-ray." In reading the evidence in the current Bolton study, it would seem the above quotations were words of caution uttered many years ago by one who knew much about impacted teeth.

H. C. P.

Harvard School of Dental Medicine

Particularly those who have carefully followed the development and progress of the specialty of orthodontics were without surprise when it was announced that Dr. A. LeRoy Johnson of New York had been selected as executive officer of the Administrative Committee of the Harvard School of Dental Medicine. For many years Dr. Johnson has been one of the important contributors to the advancement of dentistry as a science. This JOURNAL has recorded much of his manuscript; therefore the readers of the AMERICAN JOURNAL OF ORTHODONTICS AND ORAL SURGERY have particularly had the opportunity to observe step by step the concept that he has assembled of the entire comprehensive dental problem—a perspective not unlike that of the trained scientific viewpoint; that is to say, thoroughly understand the problem before seeking the solution to it.

It is noted that admission to the Harvard School of Dental Medicine now is the same as that for the Medical School, and the first two sessions, devoted to the basic medical sciences, are the same for the two schools. There obviously is no segregation of the medical and dental classes and the students of the School of Dental Medicine are required to meet the same high standards of scholarship as are the medical students. In short, the successful completion of the first two sessions of study in the Medical School is required for admission to the School of Dental Medicine.

Experience in applied dental technique, it is noted, begins in the third and continues to the end of the fourth session, when the degree of D.M.D. is awarded. During the third and fourth sessions, subjects bearing on the nature of oral disease and deformities, their relation to systemic conditions and their treatment are taken up in seminars and clinical conferences in charge of the medical and dental faculties. Students who have received the D.M.D. degree may register in the Medical School and qualify for the M.D. degree on the completion of approximately twelve calendar months of additional study.

Some have felt that both medicine and dentistry are incapable of their potential best service because of the obvious gap existing between the two professions in general—concept and training. Dentistry seems to know little about real scientific medicine and medicine is equally weak and indifferent in its knowledge of the oral area.

It is recalled that through a grant by the Rockefeller Foundation, an experiment was inaugurated at the Yale School of Medicine some eight years ago. It appears that from this experiment sufficient information was assembled about the proposed bridging of the so-called medical-dental gap that the Carnegie Corporation, the Rockefeller Foundation, and the Mary Markle Fund were inspired to contribute $600,000, $400,000, and $250,000 respectively to the trial of the innovation at Harvard University.

Dr. Johnson, who has been called to direct this program, is one of the co-workers who collaborated with the late Dr. Charles B. Stockard in the preparation of the monograph, "The Constitutional Basis of Form and Behavior," as the representative in the field of orthodontics. His most recent paper published in the JOURNAL is "The Constitutional Factor in Skull Form and Dental Occlusion," which appeared in July, 1940.

To those who have followed the Johnson work, the Harvard plan, which proposes that during the third and fourth sessions subjects bearing on the nature of oral disease and deformities, their relation to systemic conditions, and their treatment, reveals how the plan functions and how far-reaching is the effort. In no department of dentistry is thorough training in the concepts of modern scientific medicine more to be desired than in the practice of orthodontics, because orthodontists have been some of the first to realize their educational limitations. Through clinical experience they have learned that malocclusion of the teeth has a close tie-in with the general systemic conditions of the human body.

As a compromise to these limitations some have been content to stress the technical, corrective mechanical procedure alone and rely upon its efficiency and skillful manipulation to supply the answer to manifest orthodontic limitations in practice. Others obviously believe that mechanical corrective procedures alone, their intrinsic merits notwithstanding, begin with mechanics and end there and are only one leg of the stool to be built for the ultimate solution of the orthodontic problem, just as spectacles are only one leg to the stool of the eye problem.

On account of the Johnson background perhaps the new plan will succeed in adding something to orthodontic research and help to join the breach that stands conspicuously between orthodontic mechanics on the one hand and a series of etiologic unknowns on the other.

There is an orthodontic research problem practically untouched that lies some place within the field of scientific medicine, many will agree, and in doing so they will desire to see medically well-trained minds become interested in the orthodontic problem, as well as other departments of dentistry.

H. C. P.

Since the above was written, on account of the dislocation of the times and the Army and Navy technical educational plans, it is understood the above plan has been somewhat altered to meet changed conditions; however, there is no intention apparently of abandoning the fundamental principles in this re-orientation of the dental program or of abandoning the teaching of dentistry.—H. C. P.



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There may be members in the Service whose names do not appear in the above list. These members should notify the secretary at once so that their names may be included.

Max E. Ernst, Secretary, American Association of Orthodontists, 1250 Lowry Medical Arts Bldg., St. Paul, Minn.

Department of Orthodontic Abstracts and Reviews

Edited by

Dr. J. A. Salzmann, New York City

All communications concerning further information about abstracted material and the acceptance of articles or books for consideration in this department should be addressed to Dr. J. A. Salzmann, 654 Madison Avenue, New York City

Regulating Mechanism of the Carotid Sinus and Its Influence in the Dental Chair: By Dr. Servando Garcia Faure, *Revista del Circulo Odontologico de Cordoba,* July, 1942, Argentina.

After mentioning numerous observations and physiologic experiences upon the receptive zone of reflexes in the carotid sinus, done in human and animal subjects, the author refers to the Ortner experiment (massage of the carotid sinus) and the modifications on the arterial pressure and pulse provoked by it. In this article he touches on pulse modifications.

The studies were verified mainly upon students of the College (Cordoba College of Dentistry), ages varying from 20 to 30 years. All measurements were done in the morning after breakfast from 9 A.M. to 12 noon. Using the pulse-meter Faure took the frequency, taking as a base 30 pulsations and doing in each subject a minimum of seven measurements and a maximum of 26.

In order to eliminate as much as possible emotional factors, the subjects were previously informed about the experiments, and the day on which last measurements were taken we began with Series No. 1 (in normal position) after the pulse was more or less stabilized and close to normal. As a rule in all the positions the subjects had their collars loosened in order to avoid any artificial hindering on circulation, mainly on the return circulation.

The order in which series were taken was, namely:

1. Normal position
2. Forced head
3. Forced thorax and normal head
4. Normal thorax and forced head

No. 1 Normal position.—Patient is seated on the dental chair as you would normally sit on an ordinary chair. Head of the patient does not touch the headpiece.

No. 2 Forced head.—The back of the chair has an inclination of 120 degrees. The headpiece diverges abruptly from the direction of the back. The patient's head is forced back in this direction.

No. 3 Forced thorax and normal head.—Thorax of the patient is unnaturally forced against the back of the chair; the head, however, is in normal relation with the trunk.

No. 4 Normal thorax and forced head.—Position reverse from No. 3. Thorax is in natural, nonforced position. Head forced as in No. 2.

Over these four positions, respectively, measurements were taken on a total of 89 students.

The medium term of frequency in the four series is different and, according with the order in which measurements were taken, varies from a minimum point in the No. 1 (normal position), to ascend at a maximum in No. 2, descending approximately at the level of the normal in No. 3 and ascending again in No. 4 at about the level of No. 2.

In No. 3 only the thorax was in forced position in order to clarify the importance that respiration or muscular effort of the thorax could have in the variation of frequency.

Nos. 2 and 4 have in common the forced back position of the head; so really the proximity of results in Nos. 1 and 3 as in Nos. 2 and 4 makes only two groups: the first without forced action upon the neck, the second acting directly upon it.

The author interprets these variations as due to the proved regulating action present in the carotid sinus; according to him, positions No. 2 and No. 4 which cause the maximum variations produce either an elbowed position or mainly an elongation of the carotid, thus diminishing its volume and causing a situation of hypotension which acts as an exciting agent over the reflex mechanism of the sinus and thus producing a compensating acceleration of the cardiac muscle.

He recalls cases of shock due to the hyperactivity of the carotid reflexes and the danger involved in manipulations on the neck of subjects suffering from this exaggeration of reflexes.

The author concludes that positions which in the dental chair bent the head back, forcing the neck, incite tachycardia. Tachycardia thus provoked varies according to the subject in study from 2 to 30 per cent with a medium term of 16 per cent. This tachycardia is independent of the muscular effort and respiratory rhythm that these forced positions could provoke. Besides illumination, visibility, and accessibility, dentists must take care about avoiding forced head positions which are liable on certain conditions to establish serious and unpleasant situations.

Carlos Giro, D.D.S.

Fractures of the Jaws and Other Facial Bones: By Glenn Major, B.S., A.M. (in Pathology), M.S. (in Experimental Surgery), Ph.D. (in Surgery), D.D.S., M.D., F.A.C.S., Pittsburgh, With Chapters on Radiographic Technic by Lester M. J. Friedman, B.S., M.D., Formerly Assistant Radiologist, Department of Diagnostic Roentgenology; Now Acting Director, Department of Radiation Therapy, The Western Pennsylvania Hospital, Pittsburgh, and War Aspects of Jaw Fractures by Arthur Dick, D.D.S., M.D., Major, Medical Corps, Army of the United States, With 225 Illustrations, Pp. 446, Price $7.50, St. Louis, The C. V. Mosby Co., 1943.

While the shortcomings of the medical surgeon in treating jaw fractures usually lie in his lack of attention to the exact re-establishment of the occlusion of the teeth, that of the dentist involves knowledge of the altered physiology,

pathology, and the surgical principles involved in these injuries. This book attempts to overcome these deficiencies.

Although fractures of the mandible are found to occur with greater frequency than those of the other facial bones, and have certainly received more consideration in dental texts, the author has given due consideration to fractures of the maxilla, malar, zygoma and nasal bones. Emergency treatment of facial fractures is discussed, as are anesthesia and the management of fragments.

"Radiographic Technic" by Friedman includes a discussion of the equipment and methods of projecting various facial areas. These are fully illustrated.

"War Aspects of Jaw Fractures" by Arthur Dick includes instructions on first aid, transportation, arrest of hemorrhage, treatment of wounds, and bandaging. Reduction and fixation of jaw fractures are discussed and illustrated. This should prove a valuable feature during the present war emergency. A chapter on medicolegal complications is included since it is recognized that most law suits in dentistry arise from unsatisfactory results in this field.

Outline of Histology: By Margaret M. Hoskins, Ph.D., and Gerrit Bevelander, Ph.D., Departments of Anatomy, College of Dentistry and the Graduate School of Arts and Science, New York University, St. Louis, The C. V. Mosby Company, 1942.

This is an excellent student text from the standpoint of content as well as physical make-up. Ample space is provided for students' notes. The material is presented in a teleologic manner and the illustrations are clear and adequate. Dental and medical textbooks have long remained behind in method of presentation and format in comparison to such books in other fields. Although it has long been recognized that textbooks have a faculty for going out of date, some joining this category as soon as they are off the press, authors and publishers have done nothing about it. It is gratifying, therefore, to see that Hoskins and Bevelander and The C. V. Mosby Company have taken advantage of the modern methods of textbook making. The student using this book is indeed fortunate since he will not have to contend with the type of illustrations that those who attended college in past years had to face.

Among the topics covered are the epithelia; connective and supporting tissues; muscle; nerves and the circulatory and lymphatic system. Part II of this book is devoted to dental histology and embryology.

The development of the face is briefly explained and illustrated as are the development of the tongue and palate. Since this is a text on histology and not on developmental anatomy, it is, of course, not to be expected that these subjects would be treated extensively.

One is at a loss to understand why theories are mentioned without direct reference to the proponents of these respective theories, as on Page 41 in the Chapter on Development of Enamel. It might be well to include references to the works of others and a subject index in future editions.

Dental Appointments

The *Washington State Dental Journal* publishes the following letter which should prove helpful also in other localities:

SEATTLE PUBLIC SCHOOLS

August 11, 1942

Dr. Harry N. Moore, President
Seattle District Dental Society
Cobb Building
Seattle, Washington

Dear Dr. Moore:

Re: School Pupils' Dentist and Orthodontist Appointments

The War Production Transport Commission has urged that the number of school children using the city bus facilities between the hours of 4:00 and 6:00 o'clock be kept to an absolute minimum because of the great burden thrown on these facilities during these hours by the workers in war industries. The Commission has requested as a part of this program that dentist and orthodontist appointments with school children avoid the hours immediately after the close of school. The proposals herein contained in line with this request are the result of conversations between representatives of the Seattle School District, and Dr. Harry N. Moore, chairman of the Dentists' Committee, and are submitted as temporary measures to help alleviate the present transportation emergency.

1. Dentists should continue to make appointments with school children on Saturdays and otherwise out-of-school hours wherever the problem of transportation congestion can be avoided. The educational welfare of the school pupil requires that the school day be interrupted as infrequently as possible.

2. Dentist appointments during school hours should be made so that the pupil will miss a minimum of school time. State law requires pupil attendance of at least one hour in the morning and one hour in the afternoon session before state and county attendance money can be apportioned. The financial loss to the District, therefore, can be very great if a large number of half-day absences are occasioned by these appointments.

3. Early morning appointments with school children will consume the least school day time and should be used as much as possible. Parents who drive regularly to their work should be encouraged to take their children for such appointments. Use of city transportation facilities thus can be avoided.

4. The School District will require the pupil use of a dentist appointment card. This card will be furnished by the School District and must be returned to the school by the pupil immediately after his appointment properly signed by the dentist. A copy of this proposed card is submitted.

The Seattle School District will wish to observe and review its experience with the plan outlined above from time to time, and whenever occasion arises will wish to confer further regarding modifications.

Yours very truly,

E. W. Campbell,
Assistant Superintendent

News and Notes

Washington-Baltimore Society of Orthodontists

The newly elected officers of the Washington-Baltimore Society of Orthodontists are: President, Dr. Stephen C. Hopkins, Washington, D. C.; Vice-President, Dr. Meyer Eggnatz, Baltimore, Md.; and Secretary-Treasurer, Dr. William Kress, Baltimore, Md.

Denver Summer Seminar Cancelled

The Board of Directors of the Denver Summer Seminar announces that the seminar for the year 1943 has been cancelled because of transportation difficulties and other wartime restrictions.

GEORGE S. SIERSMA, Secretary

Prize Essay Contest Postponed

The Research Committee of the American Association of Orthodontists announces the postponement of the Prize Essay Contest until the next meeting is called by the Association.

In order that those contestants who have already submitted manuscripts may not be discriminated against through this action, and also to make their studies available to the rest of the profession, their manuscripts are being returned to them with full authority for publication, wherever they may place them. A list of such manuscripts is being held in the office of the chairman, and the manuscripts or reprints thereof will be called for at the time of the judging.

The deadline for submission of manuscripts has been postponed indefinitely and new manuscripts may be submitted for consideration at any time until further notice. All manuscripts will be judged at the same time.

State Quotas for Dentists for Armed Forces

The Chairman of the American Dental Association War Service Committee, Dr. C. Willard Camalier, has issued the following release to various state chairmen, pertaining to state quotas for dentists needed in the Armed Forces:

The following release to State Chairmen for Dentists in States having quotas for 1943, dated April 8, 1943, regarding change in age limit of dentists eligible for commissions, has been issued by the Directing Board of the Procurement and Assignment Service:

> It has been obvious for some time that it will be difficult to fill State quotas for dentists within the upper age limit of the 39th birthday. The Officer Procurement Service is announcing to their district offices that this limit has been increased to 42. However, their willingness to do this was dependent upon assurance from Procurement and Assignment Service that each State Chairman would submit the names in chronological order, that is, all available dentists age 38 and under until the supply is exhausted, then all available dentists age 39 until the supply is exhausted, and then those age 40 and 41 in turn. Their hope is, of course, to fill the ranks with those under 40 if possible.
>
> Your cooperation in this plan will be greatly appreciated since it is essential to the revisions in the upper age limit set by the Office of the Surgeon General.

The Officer Procurement Service is also notifying their district offices that commissions will be extended to dentists between the ages of 42 and 44, inclusive, who are classified 1-A by their local draft boards, provided the reclassification was not at the request of the dentist but was a routine classification by the local board.

Notes of Interest

Dr. E. Santley Butler announces the removal of his office to North Avenue Medical Bldg., 524 North Avenue, New Rochelle, N. Y. Practice limited to orthodontics.

Dr. W. E. Newcomb and Dr. M. R. Newcomb announce the removal of their offices to 964 Rose Bldg., Cleveland, Ohio. Practice limited to orthodontics.

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President, S. A. Riddett
Secretary, R. Cutler
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Oral Medicine, Pathology, Diagnosis, and Anesthesia

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VOLUME 29

JANUARY—DECEMBER, 1943

Office of the Editor: 53 Bay State Road, Boston
Published by The C. V. Mosby Company, St. Louis

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Printed in the
United States of America

Press of
The C. V. Mosby Company
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Original Articles

AN UNUSUAL CASE OF HEREDITARY FIBROUS OSTEODYSPLASIA (FRAGILITAS OSSIUM) WITH REPLACEMENT OF DENTINE BY OSTEOCEMENTUM

K. H. Thoma, D.M.D., M. C. Sosman, M.D., and G. A. Bennett, M.D.
Boston, Mass.

DR. A. C. HITZELBERGER of Utica, N. Y., sent on the x-rays and the extracted teeth of a patient, said to be 22 years of age. He stated that on examination he found her mouth unclean and her teeth neglected. The oral mucosa appeared highly inflamed, and her gingivae were hypertrophied with suppuration from the gingival margins. The teeth were in irregular alignment, and there was marked malocclusion. Many of the teeth were carious, and the enamel appeared chalky and decalcified (Fig. 1).* The teeth, all of the permanent dentition, were removed by Dr. Hitzelberger, with nitrous oxide and oxygen anesthesia, in two operations. No surgery was performed on the gingivae. The healing was uneventful.

. The roentgenograms furnished with the extracted teeth showed that most of the teeth were affected by a resorptive process which in some instances attacked the root, producing odontolytic changes, and in other instances produced resorptive areas at the periphery. Not all teeth were affected to the some extent. In some, there was only a small osteolytic area, either in the center of the root (left superior first premolar), or at the periphery (distal root of right inferior first molar, and apex of left inferior central incisor). In other teeth, the resorption had progressed so that the entire tooth was riddled (right superior canine, lateral incisor, and both central incisors), or the root had been decimated to a short stump (as in the left superior canine and right inferior lateral incisor). This patient seemed to suffer from idiopathic resorption (Thoma, 1941) which is closely related to a resorptive process which has been described by several writers under various names, viz., pink spot, internal resorption of the tooth, perforating hyperplasia of the pulp, internal granuloma of the tooth (see bibliography). Many theories have been developed regarding the cause of this affliction. The greatest argument centers about the question of whether the process starts from within, namely, from the pulp of the tooth, or whether from without the periodontal membrane. A critical review of the cases reported in the literature, and a careful study of twenty-nine cases examined in our laboratory, seem to indicate that idiopathic resorption of the tooth may start as both internal and peripheral resorption. Most case reports deal with individual teeth, but there are a few articles (Worman, 1929; Göllner, 1931; Mueller, 1931; Cahn, 1932; Moral, 1933; Hammer, 1934; Thoma, 1935; Fischer, 1936; Rosenthal, 1936; Soifer, 1937; and Lepp, 1938) in which several teeth

From the Department of Oral and Plastic Surgery, Harvard School of Dental Medicine and the Peter Bent Brigham Hospital, Boston.

*Figs. 1, 10, and 27 appear grouped as a color insert.

were involved, either at one time or in succession. This might indicate a systemic factor at work which is not understood at present. The case submitted by Dr. Hitzelberger not only had more teeth involved than have ever been reported, but differed also in other respects, therefore it seemed an ideal case to investigate and report.

Negotiations were started to have the patient come to Boston for a general examination, during which the fact came out that the mother was suffering from a skeletal disease, so finally both mother and daughter were persuaded to make the trip and were admitted in the Peter Bent Brigham Hospital on May 18, 1942. The following are the reports of the examination of the patient, I. H., and her mother, B. H. We are indebted to Dr. Oliver K. Scott and Dr. Clark Case for compiling these case histories.

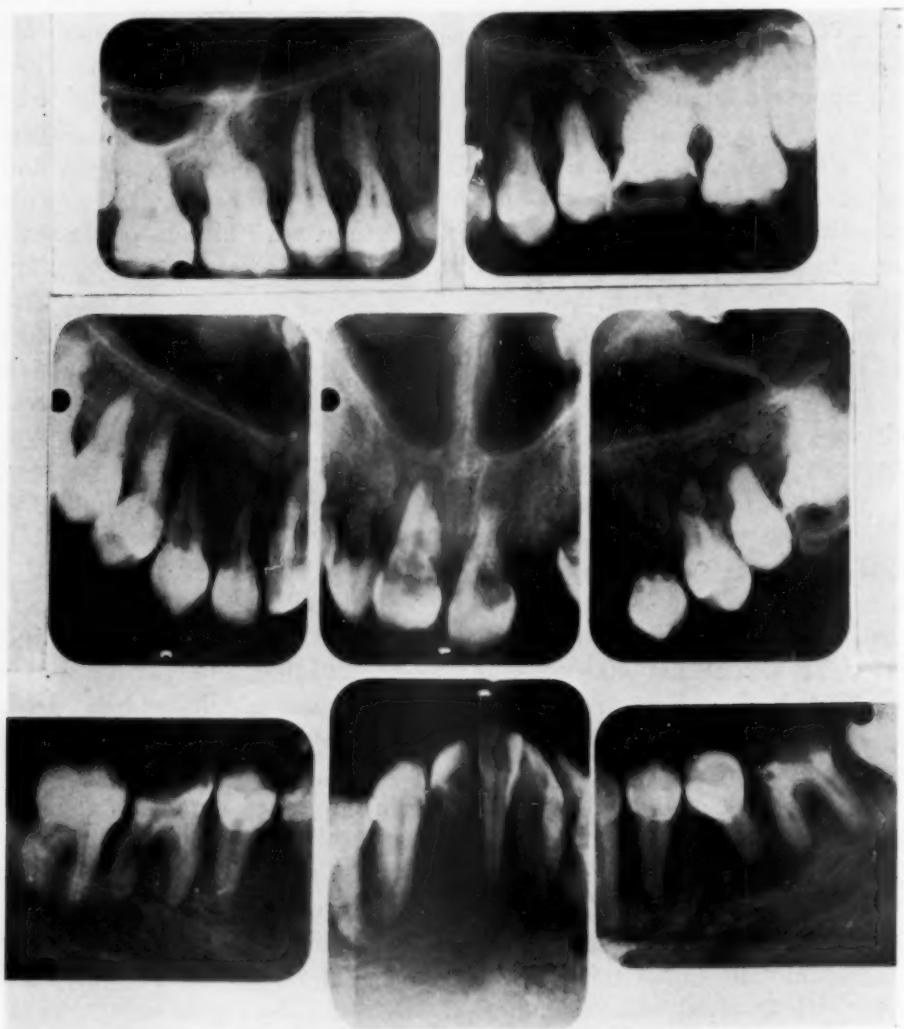


Fig. 2.—Roentgen film of teeth showing odontolytic defects.

The Patient, I. H.

This 22-year-old girl came to the Peter Bent Brigham Hospital with her mother for investigative studies of bone deformity. She is a member of a

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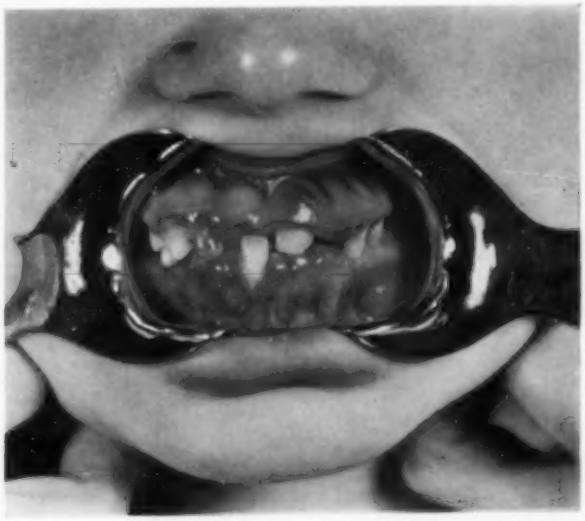


Fig. 1.—Girl, aged 22 years, with malocclusion, carious teeth, and gingivitis.

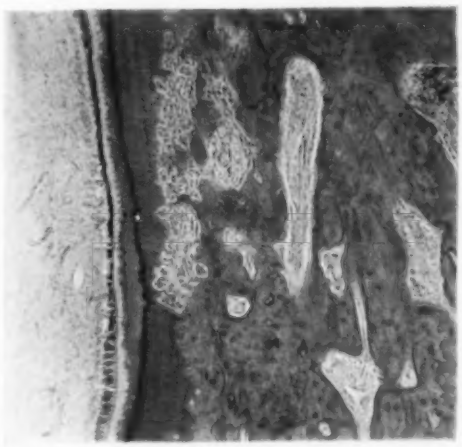


Fig. 10.—High-power field from *RM3* (Fig. 8), showing dentine wall joined by deposit of osteocementum. (Kodachrome.)



Fig. 27.—High-power field from *RM2* (Fig. 26, square) showing lacunar resorption of dentine with osteoclast.

family, six of whom show skeletal deformities, progressive deafness, and fragility of their bones. She has not gone beyond the eighth grade and has repeated several years in school. As far back as she can remember she has had slight deformities. She has lost all of her teeth and is very slightly deaf.

Physical Examination.—Temperature was 98.4° F., pulse 120, respirations, 20, blood pressure 120/80. The patient was a well-nourished girl, looking younger than her stated age, 5 feet in height. She had broad features, with slight frontal bossing and a saddle type nose. Arms were straight. Legs showed anterior bowing of both femora and tibiae, with enlargement of the anteroposterior diameter of the tibia. Chest was rounded with increased anteroposterior diameter. Sclerae were not abnormally blue. There was slight diminution of hearing on the left and complete adentia. Lungs were clear. Heart appeared normal. Abdomen was negative.



Fig. 3.—Roentgenogram of I. H. showing bowing of tibiae with cystic areas.

Laboratory studies showed a red count of 4,000,000, hemoglobin 13.5, hematocrit, 42, sedimentation rate, 24, white count, 9,800 with 70 per cent polymorphonuclears. Urine was negative; blood urea nitrogen, 11; total protein 7, cholesterol 197, calcium 5.1 meq./l., phosphorus 1.2 meq./l., phosphatase 22.4 Bodansky units. Stool was negative for guaiac. Sulkowitz test showed low calcium urinary excretion.

Roentgen Examination.—Films of the long bones, arms, forearms, hands, femora, legs and feet showed a most peculiar disturbance with marked anterior bowing of the tibiae (Fig. 3), marked thickening of the cortex of many of the bones, particularly tibiae, least marked in the femora, and several pseudocystic areas, particularly in the tibiae and lower humeri. There were also scattered areas of calcification in the soft tissues, most marked behind the left knee. The small bones of the hands and feet were extensively involved. The skull showed thin bones and a fine granular detail (Fig. 4). The sella was normal. A film of the chest showed normal lung fields, a heart of normal size. Films of the spine and pelvis appeared normal.

Course in the Hospital.—It was felt that this girl would benefit by x-ray treatment, to arrest the disease and to prevent future fractures. Accordingly, she was given one treatment in the hospital, and then was discharged to have further treatments outside.



Fig. 4.—Roentgenogram of I. H. showing edentulous skull with fine granular detail.

The Mother, B. H.

The mother, a 53-year-old housewife, came to the hospital with her daughter for special study relating to skeletal deformities. Her condition is apparently hereditary and familial. Her father, two brothers, one son, and one daughter have similar deformities (diagram Fig. 5). She first noticed some soreness, stiffness and swelling of her legs about eighteen or twenty years ago, after the birth of her daughter. She has broken her right arm three times with minimal trauma; each time there was slow healing but with deformity in about five to eight weeks. She has become progressively deafer over the last twenty-five

years. The deafness, bone fragility, and bone deformities, especially the bowing of the legs, have been characteristic of all members of the family involved. There was no history of renal symptomatology.

Physical Examination.—Temperature was 99.4° F., pulse, 96, respirations, 18, blood pressure, 120/80. The mother was a short, stocky, greatly deformed woman measuring 5 feet 2 inches. There were shortening and marked deformity of the right arm, with almost no elbow motion. There was considerable widening of the humerus with fracture deformity and widening at the elbow joint. The left humerus was thickened and bowed anteriorly. The left leg showed great thickening of the bony parts with anterior bowing in the lower portion. There was atrophy of the right calf muscles. Over the involved bones the skin was fairly warm and slightly reddened. A number of the teeth had been lost and those remaining were carious but not loosened. Chest was clear. Breasts were rather small. Heart was not enlarged, with regular rhythm, and grade 2 apical systolic murmur. Liver was down 3 fingerbreadths. Spleen was not palpable. Neurological examination was negative.

Laboratory Studies.—Urine showed a specific gravity of 1.026, with no albumin, with rather numerous white cells, no red cells, negative sediment otherwise. Hemoglobin, 12 Gm. per cent, hematocrit, 46, sedimentation rate, 39, white count, 5,200 with 70 per cent neutrophiles. Stool was negative for guaiac. Nonprotein nitrogen was 28; serum protein 7.3 with 4 grams of albumin and 3.3 grams of globulin; calcium 5 meq./l., phosphorus 1.1 meq./l., phosphatase 38 Bodansky units.

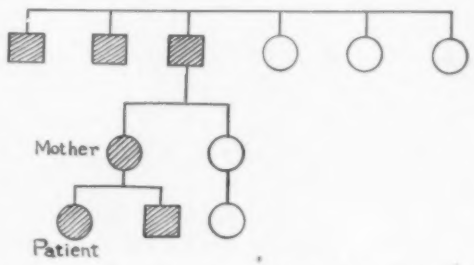


Fig. 5.—Pedigree of "H" family. Hatched squares indicate males and hatched circles, females affected by deafness and fragile bones.

Roentgen Examination.—Films of the teeth showed many areas of caries, but no resorption as seen in the daughter. There were several apical granulomas. The lamina dura was present around most of the teeth. A film of the skull showed the cranial vault to be quite thin. The bones showed a peculiar, fine granular appearance. Sella was normal. Films of the long bones showed huge cystic areas in both humeri and in the left fibula. The humeri were considerably deformed with marked bowing on the left and multiple angulations on the right, suggesting old fractures (Fig. 6). There was slight abnormality of the radius and ulna, most marked at the lower end of the right radius. The long bones appeared somewhat decalcified. The femora were most nearly normal. Films of the spine showed a diffuse decalcification but no changes in the structure. A film of the chest showed the lungs to be clear. Heart was

slightly enlarged to the left. The left fibula was greatly enlarged and cystic in character. The tibia was not particularly enlarged (Fig. 7). Biopsy of the left fibula was performed on the sixth hospital day. Three x-ray treatments were given on the ninth, tenth, and eleventh hospital days to the cystic areas in the bones. The patient was then discharged but was remaining outside the hospital and coming in for further x-ray therapy. It was hoped that the x-ray treatments by sclerosis of the bones would prevent future fractures.



Fig. 6.—Roentgenogram of B. H. showing huge cystic areas in both humeri with bowing and multiple angulations on the right suggesting old fractures.

Pathologic Findings.—The material received is a biopsy taken from the fibula. Gross description: The specimen consists of two small fragments of tissue which are somewhat bony in consistency, apparently representing the cancellous portion of bone. The largest of these measures 1 by 0.8 by 0.6 cm. in size, and presents no particularly remarkable characteristics. The other is only slightly smaller and is softer in consistency. Impression: deferred.

Microscopic Report.—These sections show a number of thin spicules of markedly atypical bone. Interpretation is difficult since no orientation as to the plane of section in relation to the cortical bone exists. The bone spicules are thin. The bone proper suggests imperfect calcification. Around the bone spicules a large rim of very conspicuous and prominent large-sized osteoblasts are present. In addition there are numerous osteoclasts. Between the bone

spicules a fairly dense and fibrillar connective tissue is found. It is moderately vascular. It does not contain any bone marrow elements. In some areas though, some slightly fibrosed adipose tissue is encountered. Again the large size and prominence of osteoblasts should be stressed.

The sections have been submitted to Dr. Wolbach who commented on the above-described features. He felt that he could exclude all familiar types of bone disease including Paget's disease although there is some resemblance to it. In view of the lack of knowledge concerning the sequence of events in fragilitas ossium as well as in view of the familial history of this case and of the clinical finding, it seems permissible to Dr. Wolbach to regard this as a probably undescribed change in the sequence of events of fragilitas ossium. He felt that for the purpose of cataloging and accessibility of the material, it should be recorded as probably consistent with fragilitas ossium.



Fig. 7.—Roentgenogram showing left fibula greatly enlarged, with cystic areas.

Diagnosis.—Atypical bone formation probably consistent with some stage of fragilitas ossium. (W. H. Sheldon, resident pathologist.)

DENTAL PATHOLOGY OF I. H.

Sections were made of eleven teeth, all of which were affected more or less by the resorptive process, and replacement of dentine by bone. Five maxillary anterior teeth, a maxillary premolar and molar, and three mandibular

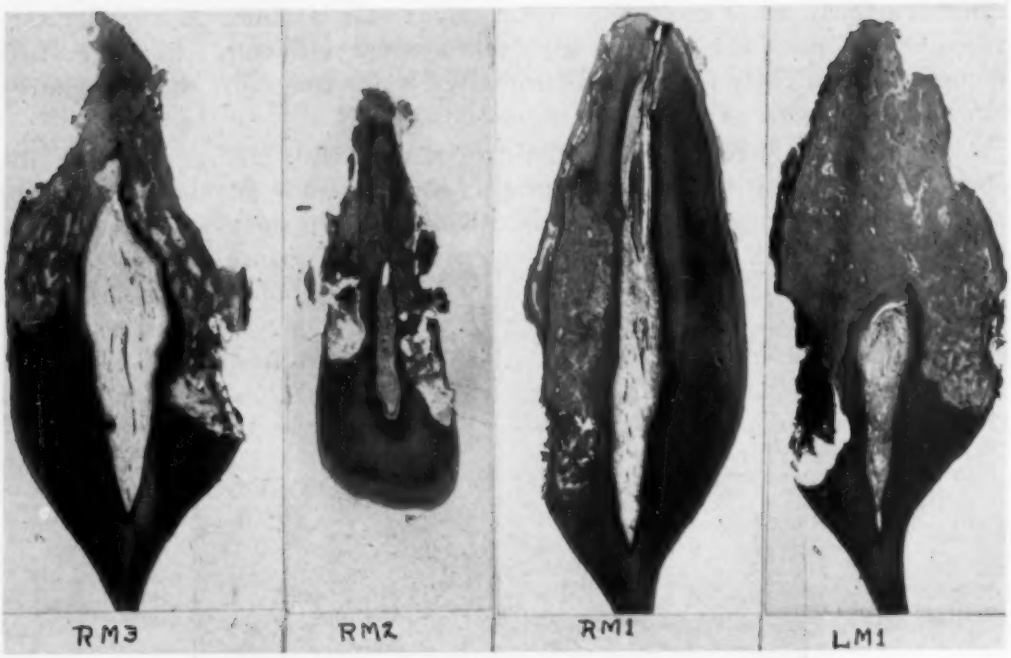


Fig. 8.—Low-power photomicrographs of right maxillary canine (*RM3*), right maxillary second (*RM2*) and first incisor (*RM1*), and left maxillary first incisor (*LM1*).



Fig. 9.—Labial wall of root of *RM3*. *P*, Pulp. Note trabeculae of osteocementum replacing dentine.

incisors will be described. Low-power sections of four of the anterior maxillary teeth are shown in Fig. 8. A detailed description follows.

The Right Maxillary Canine.—The dentine of the crown of this tooth is intact. Here incremental lines are well marked and "interglobular spaces" are very numerous, especially in the peripheral half of the dentine wall. The pulp of this tooth is unusually large for the age of the patient (22 years). It is made up of dense connective tissue and contains normal blood vessels and nerve fibers. Peripherally, active appearing odontoblasts are separated from the pulp tissue by the layer of Weil. The odontoblastic processes extend through a layer of dentinoid of normal width for the stage of development of the tooth. As we proceed to follow this layer of dentinoid toward the apex, however, we notice that it increases in width to thrice its normal thickness, being composed of a clear eosin-staining zone and a spotty zone such as is seen in rickets. It seems as if in the part of the tooth affected by the resorptive process the odontoblasts were stimulated to greater activity to protect the pulp. Fig. 8 *(RM3)* shows how much of the tooth was replaced by osteodentine; Fig. 9 shows the labial wall of the root in higher magnification. On the



Fig. 11.—High-power field from *RM3* (Fig. 9, square) showing replacement of lamellar cementum by osteocementum.

left (Fig. 10) we see the remaining dentine wall. Below, or crownward, the ragged remains of the primary dentine are seen, the appearance being due to lacunar resorption. The apposition of osteocementum has been joined directly to the dentine surface; there are no spaces left between the two at any place. On the right the bone has not only replaced the dentine completely, but also some of the lamellar cementum as seen in Fig. 11. This old lamellar cementum stops suddenly about halfway to the apex from the cervical margin of the tooth. Fig. 12 shows the periphery of the root apex which is irregular in outline. It is surrounded by a thin layer of connective tissue which has produced

a layer of cementoblasts. These appear to lay down an uncalcified homogeneous matrix from which the osteocementum is formed. Only in a few areas is there an indication of the inclusion of Sharpey's fibers; here the substance is added in a vertical direction and not parallel to the surface as is the case in bone and osteocementum. The tissue, like lamellar cementum, takes the hematoxylin stain. In many places the peripheral connective tissue is more abundant and gives rise to the formation of cementicles (Fig. 13), evidence of connective tissue activity.



Fig. 12.—Apex of *RM3* made up completely of osteocementum.

The Right Maxillary Second Incisor.—This tooth is seen in the Kodachrome illustration (Fig. 1) in labial occlusion. Microscopic examination shows that it is completely infected; apparently it was surrounded by pyogenic tissue (Fig. 8, *RM2*). The x-ray (Fig. 2) shows a deep pocket extending along the distal side of the root as far as the apex of the tooth, which appears very indistinct and partly resorbed. The resorptive process has extended far into the crown of the tooth and a large resorptive cavity is found both on the mesial and distal sides (Fig. 15). At the periphery on each side there is a remnant of dentine, more or less collapsed because the supporting enamel has been removed during the process of decalcification. On the left, cementum covers part of the dentine, sticking out at the place where it overlapped the enamel slightly. At the lower end of the resorptive cavity we note an invasion of inflammatory granulation tissue derived from the periodontium. On the left

this carried with it proliferating crevicular epithelium. The pulp of the tooth is not perforated as far as can be determined by the examination of a number of sections cut at various depths.

The root of the tooth has been completely resorbed and replaced by osteocementum. At the apex there is a large opening which leads directly into the pulp canal (Fig. 14). The inflammatory granulation tissue surrounds the entire root replacing the normal tissue of the periodontal membrane. The pulp is involved, and as there is no evidence of caries or exposure in the crown, this must be attributed to an ascending pulpitis.

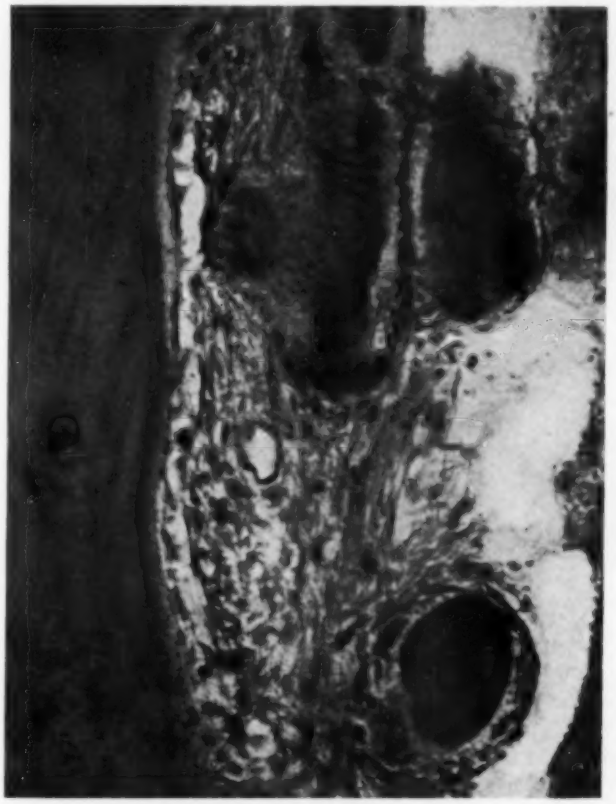


Fig. 13.—High-power field of *RM3* showing osteocementum (*O*) joined by connective tissue in which cementicles have formed (*C*).

The osteocementum of which the root is composed appears necrotic, the lacunae which contained cement corpuscles are empty, and apposition has ceased except in small areas where genetic cells have survived. The pulp is heavily infiltrated by inflammatory cells, both polymorphonuclear leucocytes and mononuclear ones. In the coronal end there is still evidence of odontoblastic activity which extends as far as the wall of old dentine. In the radicular part of the canal the odontoblastic layer is completely absent; occasionally a cementoblast is seen adjoining the osteodentine, but in general all pulp cells have been replaced by vascular inflammatory granulation tissue through which pass nerve fibers and blood vessels. The findings indicate acute and chronic inflammation of the periodontal membrane and the pulp, with necrosis of the pulp.

The Right Maxillary First Incisor.—In this tooth the lingual side appears almost unaffected by the resorptive process, which, however, is very marked on the labial side (Fig. 8, *RM1*). Here it extends almost as far into the crown as the end of the pulp canal and apparently has removed all structure as far as the periphery which was covered with enamel before preparation of the section. At the root the peripheral lamellar cementum remained practically un-



Fig. 14.

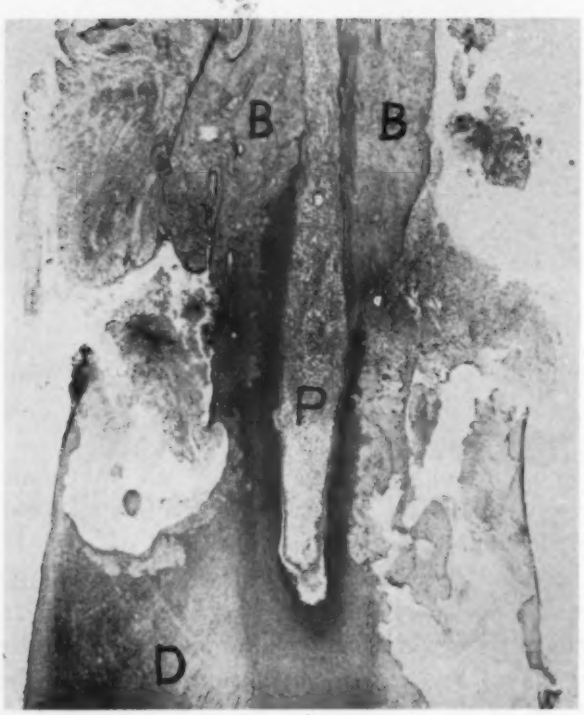


Fig. 15.

Figs. 14 and 15.—Low-power photomicrographs of *RM2*. Fig. 14 shows root; Fig. 15 crown part of tooth. *D*, Dentine; *P*, pulp; *B*, osteocementum.

affected for two-thirds of the distance; the apical third, however, shows complete resorption and replacement by osteocementum, which again shows apposition of uncalcified matrix which is lined by cementoblasts. The root at the labial surface has attached to it the alveolar plate from which it is separated by the periodontal membrane. In the upper two-thirds of the root the principal fibers are well developed and extend as Sharpey's fibers into the lamellar

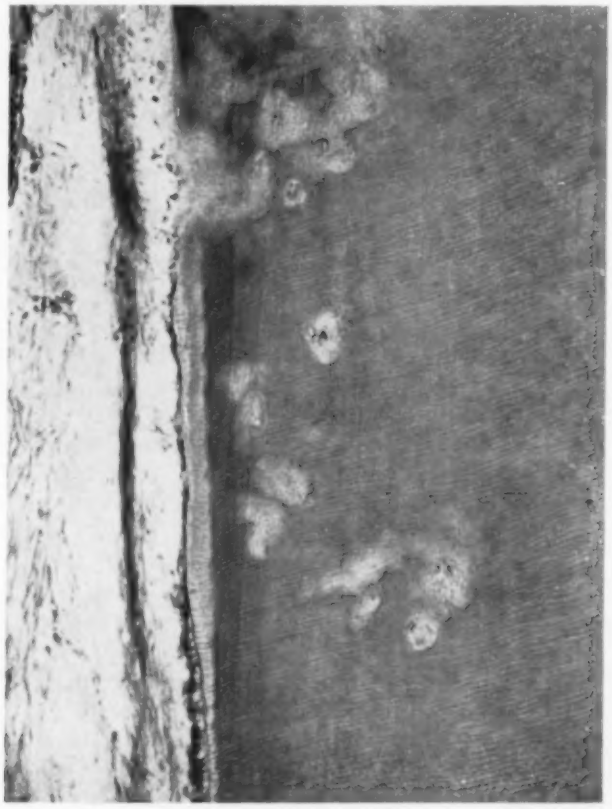


Fig. 16.—High-power photomicrograph of *RM1* showing change of columnar odontoblasts to flat ones which deposit osteocementum. Note also resorptive channels in dentine.

cementum, and on the other side into the bone. In the apical third the periodontal membrane is not as well developed, although there is evidence that fibers are joined to the tooth. On the lingual side of the root, resorption and replacement by osteocementum are seen only within the pulp canal. There is some evidence that resorptive channels now repaired by means of osteocementum have extended deep into the substance of the dentine. The odontoblastic layer suddenly changes into flat cells; tubular dentine changes into a homogenous calcified substance which shows the tendency to enclose some of its genetic cells. Thus the tooth becomes lined on the pulpal side with osteocementum (Fig. 16). The pulp tissue is fibrous, and so is the vascular connective tissue between the trabeculae of osteocementum replacing the dentine substance. There is evidence of resorption and active new formation (Fig. 17).

The Left Maxillary First Incisor.—In this tooth, as in the maxillary right canine, a very large part of the dentine has been replaced by osteocementum,

as is easily seen in the low-power illustration, Fig. 8 *(LM1)*. Only in the very tip of the crown has the old dentine been preserved. In the maxillary right first incisor the resorptive process extended up into the crown on the labial



Fig. 17.—Higher magnification of *RM1* showing part of labial wall with adjoining periodontal membrane and bone. Note process of resorption of dentine and new formation of osteocementum. *R*, Resorptive tissue; *D*, dentine; *C*, osteocementum; *A*, alveolar bone; *PM*, periodontal membrane; *P*, pulp.

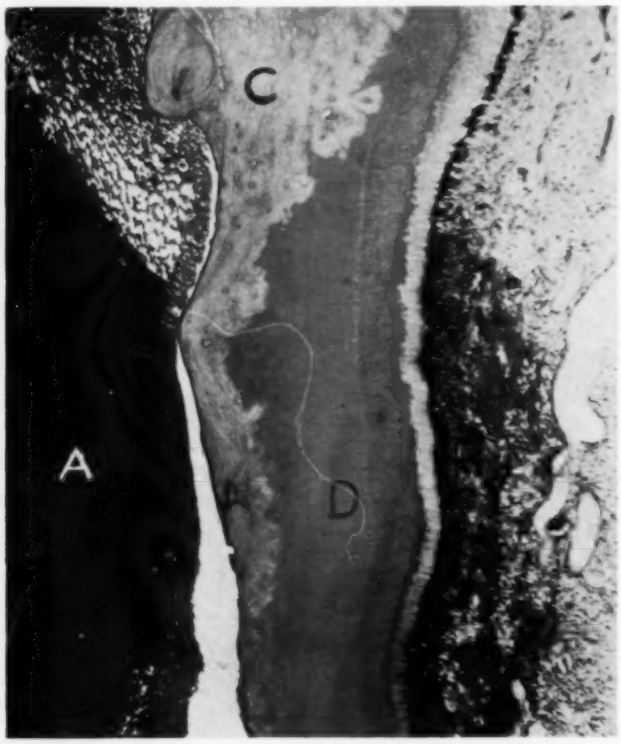


Fig. 18.—Higher magnification of *LM1* showing cavity filled with pus, *A*. Cavity is lined with osteocementum (*C*); *D*, old dentine; *P*, fibrous pulp with cell infiltration.

side, and in this tooth also the dentine has been resorbed, but the replacement has been limited to apposition of a moderate amount of osteocementum against the resorbed surface so that a cavity has formed in which there is found a residue of pus. At first this cavity appears to have been caused by dental caries, but looking at it with higher magnification it becomes clear that there is no change in the dentinal tubules, and the cavity in part is lined with a moderate amount of osteocementum (Fig. 18). As this osteocementum shows no evidence of resorptive activity at its surface where the pus is in contact with it, we must conclude that the cavity represents a resorptive process extending up from the root of the tooth (the x-ray showing the enamel cap gives this impression better than the low-power section in which the enamel has been lost). Repair apparently started but was arrested by an infectious process affecting the granulation from the crevice of the hypertrophied gingival margin. The pulp tissue in this tooth, as in the other teeth, is very fibrous, but there is no evidence of infection. Opposite the cavity the pulp tissue is extremely dense and vascular, and there is evidence of inflammation recognized by marked round-cell infiltration extending well into the surrounding parts of the pulp. The blood vessels seem enlarged here; capillaries engorged with erythrocytes are abundant in the layer of Weil and come directly into contact with the odontoblasts (Fig. 19). Although this reaction should have resulted in a deposit of secondary dentine here, there is no evidence of any such process. Apparently the irritation produced hyperemia but not osteoblastic activity, such as would occur in case of dental caries (bacterial invasion of dentinal tubules).

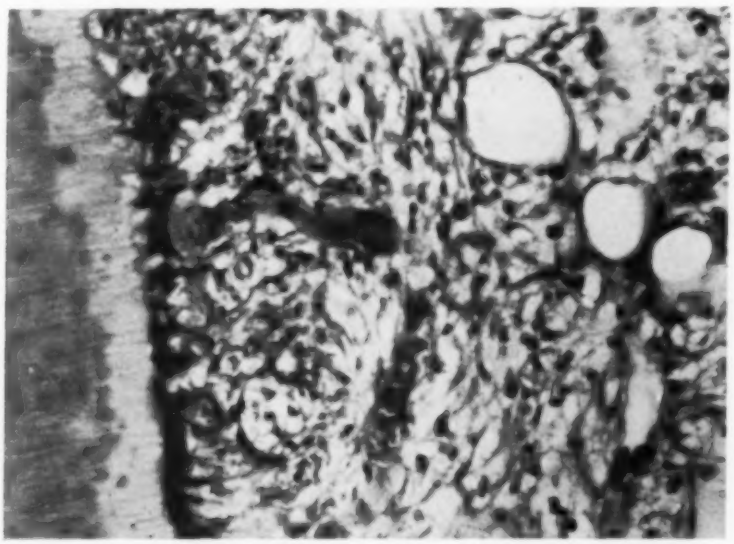


Fig. 19.—High-power view of area of pulp shown in Fig. 18, showing pulp with hyperemia, fibrosis, and round-cell infiltration.

Next comes a series of low-power photomicrographs of three additional maxillary teeth (Fig. 20).

The Left Maxillary Canine.—This tooth is very much like its mate, the right upper canine, as can be seen in Fig. 20, *LM3*. At the end of the dentine-lined pulp chamber the nutrient canal continues into the osteocementum (Fig.

21). The walls of this canal are lined with modified odontoblasts. These change from columnar shape to flat cells which first give off an occasional process extending vertically into the dentine, while later they are arranged with their long axis parallel to the surface of the deposited tissue, and show the tendency to become enclosed in the matrix they form, in the manner of cementoblasts in secondary cementum (Fig. 22).

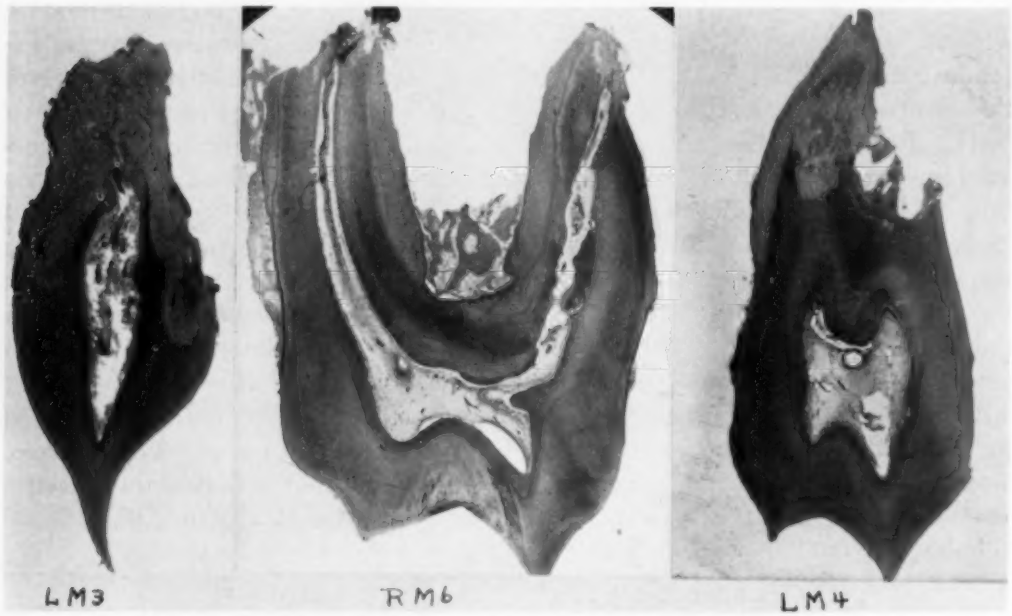


Fig. 20.—Low-power photomicrograph of left maxillary canine (*LM3*), right maxillary first molar (*RM6*), and left maxillary first premolar (*LM4*).



Fig. 21.—Photomicrograph showing end of pulp canal of *LM3*, after being lined by odontoblasts, and made up of dentine; it continues through the osteocementum.

The Right Maxillary First Molar.—A low-power photomicrograph of this tooth is shown in Fig. 20, *RM6*. The tooth is slightly carious, infected dentine extending from the occlusal surface to the roof of the pulp chamber where a protective reaction (deposit of secondary dentine) has occurred. The pulp shows evidence of retrograde processes and inflammatory infiltration forming a small focal accumulation of round cells. The palatal root (left) is surrounded by a heavy deposit of secondary cementum which does not differ from that seen in ordinary cases of hypercementosis. At the apex, however, there are the same resorptive channels as seen in the other teeth. The tissue found in these resorptive areas is very cellular and there is active deposit and apposition of an eosin-staining homogeneous matrix against the resorbed dentine



Fig. 22.—High-power photomicrograph of *LM3* (Fig. 21, square) showing change from modified columnar odontoblasts to flat cells at the end of the dentine-lined root canal.

surfaces. Blood vessels can be seen entering from the pulp into such areas (Fig. 23). The pulp canal of the buccal root (right) has areas in which a normal layer of odontoblasts can be seen adjoining tubular dentine, but there are other areas in which osteodentine has been produced. In some places this is joined to old dentine, while in others it extends directly from the mantel dentine to the pulp. At the very apex osteocementum is found enclosing areas containing fibrous tissue similar to that already described.

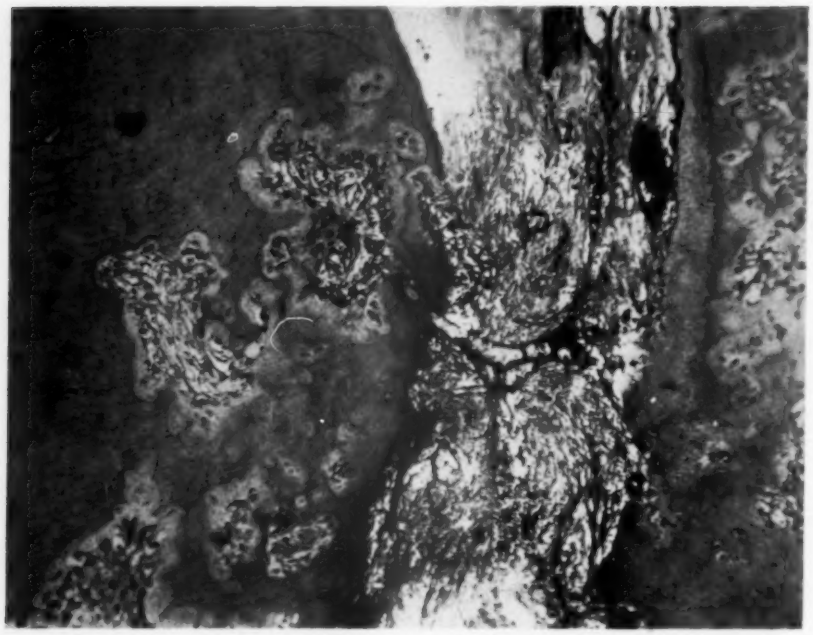


Fig. 23.—High-power photomicrograph of palatal root of *RM6*. Root canal showing blood vessels from the pulp which enter the resorptive areas in the dentine, the walls of which have become lined by eosin-staining osteocementum. *P*, Pulp.

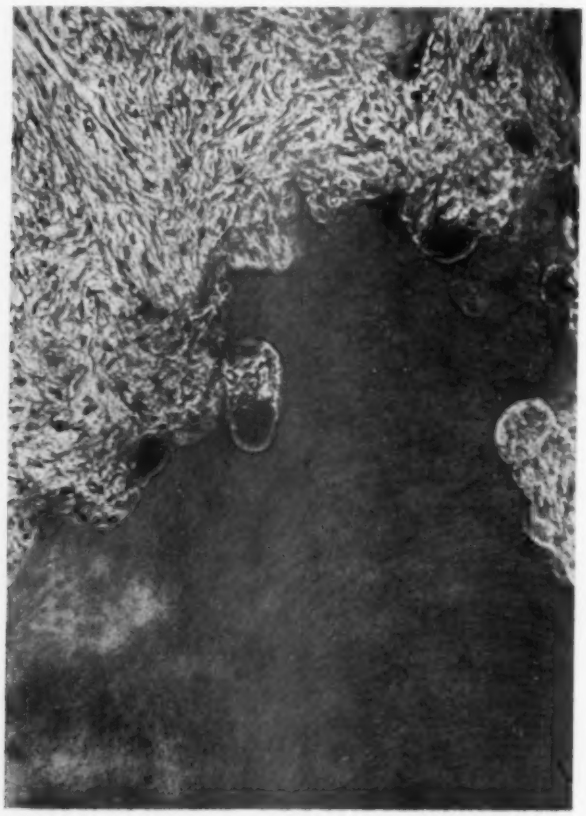


Fig. 24.—High-power photomicrograph of *LM4*, showing resorptive lacunae with osteoclasts.

The Left Maxillary First Premolar.—This tooth, like the molar, is less affected than the anterior teeth. In the x-ray, Fig. 2, we note complete resorption of one root apex and a circular osteolytic area in the other. The low-power photomicrograph, Fig. 20, *LM4*, shows that the crown and most of the root of this tooth is normal, except for the large size of the pulp canal. The root of which the apex is present has been attacked by the resorptive process from the inner side. It has completely destroyed the dentine in a globular area that reaches as far as the cementum of the tooth. In this resorptive cavity there is apposition of osteocementum with the formation of trabeculae in the apical end, but toward the crown the resorptive process can be easily studied. The resorbed dentine shows a very uneven surface, having a scalloped appearance because of numerous small and large resorptive lacunae. In these are located osteoclasts with 3-14 nuclei containing small nucleoli (Fig. 24). The soft, resorptive tissue is made up of spindle-shaped and stellate connective tissue cells, collagen fibers, and contains many blood vessels and capillaries. Trabeculae of bone are formed by lamellar deposit of osteoid. These trabeculae are surrounded by dark-staining oval cells, presumably modified cementoblasts.

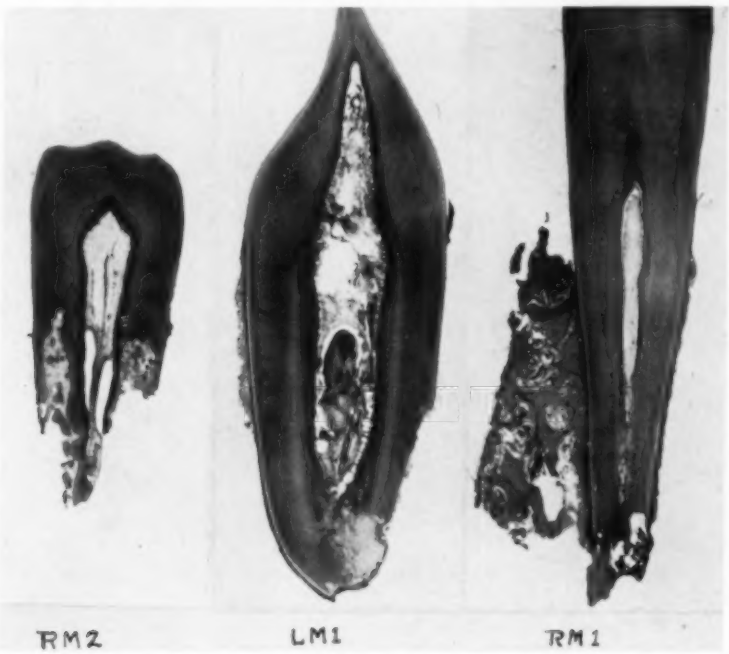


Fig. 25.—Low-power photomicrograph of the right mandibular second incisor (mesiodistal section) (*RM2*), left mandibular first incisor (labiolingual section) (*LM1*), and right mandibular first incisor (mesiodistal section) (*RM1*).

The Right Mandibular Second Incisor.—The resorptive process in this tooth extends nearly to its cervical margin. The low-power photomicrograph (Fig. 25, *RM2*) shows very well how the process proceeds in the center of the dentine wall affecting neither the young dentine near the pulp, nor the cementum at the periphery. The pulp in this tooth is normal; the two cystlike spaces are due to shrinkage. The resorptive tissue is made up of dense cellular connective tissue with abundant collagen formation and evidence of ossification (Fig. 26). Pink-staining osteoid seems to be deposited around more highly calcified, irregular trabeculae which stain with hematoxylin. Near the pulp wall are trabeculae

which are decidedly remnants of old dentine, identified by the presence of dentinal canals. Not all, however, are remnants of tooth substance which is evidenced by the fact that near the cemental side there are hematoxylin-staining trabeculae which give no indication that they are canaliculated, and which, furthermore, contain lacunae with enclaved cells. Occasionally at the periphery of the resorptive area osteoclasts are present (Fig. 27). The entire process of cellular connective tissue with the formation of collagen and trabeculae undergoing various degrees of ossification resembles very much the disease occurring so often in the jaws of young individuals, described variously, first as localized osteitis fibrosa, later as fibro-osteoma (Furedi, 1935, and Thoma, 1942) and fibrous osteoma (Phemister and Grimson, 1937).

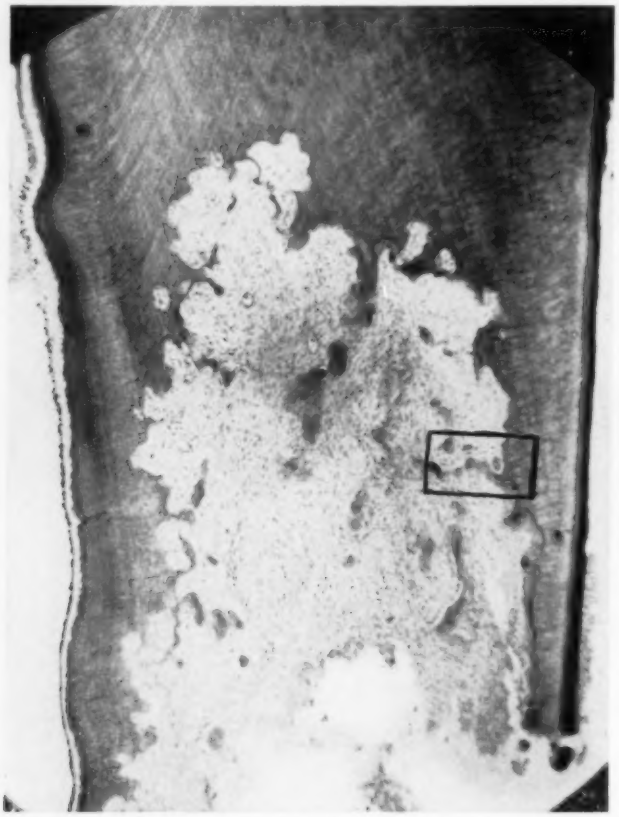


Fig. 26.—Higher magnification of *RM2* showing the resorptive area on one side of the tooth. The square outlined is shown in the Kodachrome, Fig. 27.

The Left and Right Mandibular First Incisors.—These two teeth show the disease process in the very earliest stages. The left incisor (Fig. 25, *LM1*) shows an opening at the periphery of the apex from which fibrous connective tissue extends into a resorptive cavity which is entirely filled with it (Fig. 28). The tissue is very cellular, quite vascular, and shows evidence of apposition of osteoid rather than resorption of tooth substance. The periphery is lined by an irregular seam of osteoid which is surrounded by numerous cells which seem to be producing it. Higher magnification shows the deposit of very small trabeculae of calcified tissue which in turn are also surrounded by an osteoid seam formed by oval cells, modified cementoblasts, the long axis of which is parallel to the side of the trabecula.

The right mandibular incisor (Fig. 25, *RM1*) also shows resorptive processes on the end of the root. These, however, have progressed further than in its mate. In another section the apex of this tooth is shown in higher magnification (Fig. 29). On the left, three areas of resorption of dentine are seen. On examination of other sections further on, it was found that these three areas fuse into a larger one of complicated outline filled with fibrous connective tissue which has started to cause apposition of osteoid. On the right side we see extensive resorption going on; large osteoclasts are located in Howship's lacunae at the coronal edge of the resorptive cavity. These are shown in Fig. 30 in higher magnification.



Fig. 28.—High magnification of resorptive area shown in apex of *LM1* (Fig. 25). Note vascular fibrous connective tissue surrounded by osteocementum lined by a seam of osteoid, bordered by genetic cells, modified cementoblasts. *R*, Resorptive area.

GENERAL DISCUSSION

These two unusual cases were discussed first from a roentgenologic point of view by Dr. M. C. Sosman, second, from a pathologic point of view by Dr. G. A. Bennett, and third, from an oral point of view by Dr. K. H. Thoma.

DR. SOSMAN: A discussion of the x-ray appearances in these two patients is easy, but an exact diagnosis from the x-rays alone is difficult, almost impossible. There are six possibilities which must be taken into consideration. These are arranged in an increasing degree of probability as follows:

1. Xanthomatosis or lipoid disease of bone.
2. Neurofibromatosis.

3. Paget's disease.
4. Osteitis fibrosa cystica (hyperparathyroidism).
5. Polyostotic fibrous dysplasia (Albright's disease).
6. Fragilitas ossium (osteogenesis imperfecta).

We feel that we can rule out many other diseases and conditions such as primary or metastatic tumor of bone, inflammatory conditions such as osteomyelitis, and the dyschondroplasias by the x-rays alone.



Fig. 29.—Apical end of root of *RM1*, another section of which is shown in the low-power series, Fig. 25. Note three resorptive areas in the left side of the tooth and the large resorptive area on the right. The cystic space may be due to shrinkage. Osteocementum has been deposited on the surface of the pulp canal as well as peripherally. Square is shown in Fig. 30.



Fig. 30.—High magnification of square shown in Fig. 29. Note Howship's lacunae with osteoclasts in dentine.

1. The lipoidoses of bone, xanthomatosis and Gaucher's disease, are generalized diseases and may attack any of the bones. Most commonly the xanthoma nodule destroys the bone cleanly with distinct irregular edges to the defect but no increased density or reactive bone around it. Less commonly there is diffuse infiltration of a bone or bones with hyperplasia through the involved area and increased density. This type is more common in the shafts of the long bones, while the irregular maplike or geographic areas of destruction are more common in the skull and pelvic bones. In Gaucher's disease the common findings are expansion of the diaphyseal ends of the bones, particularly the lower ends of the femora, and occasional clean-cut cystic or hollow areas in the medullary cavity with thinning of the adjacent cortical bone. Fractures are infrequent in both xanthomatosis and Gaucher's disease. These appearances were not present in our patients.

2. Neurofibromatosis of bone is rare, usually producing circular depressions in the cortex, but occasionally causing coarse striations in the cancellous bone similar to Paget's disease. It is almost invariably associated with diffuse subcutaneous neurofibromatosis and in the absence of these subcutaneous nodules should not seriously be considered in such cases as are illustrated here.

3. Paget's disease is definitely suggested by the appearance of the bones in the x-rays of the daughter particularly at the lower ends of the humeri, and also in the radii and ulnae. In these areas the cortex of the bones appears soft and spongy with coarse thickened trabeculae and a pseudocystic appearance in places. Paget's disease is a simultaneous resorption and redeposition of bone and the characteristic x-ray appearance is one of rebuilding of the bone by coarse, thickened trabeculae, fewer in number but heavier in structure than normal trabeculae. There is usually an increase in the width of the cortex or of the shaft, a narrowing of the medullary cavity by the encroachment of the new abnormal bone, frequently bowing, and occasional cystic areas in the cortex or medulla. Only the skull presents the characteristic "cotton-wool" appearance in addition to thickening, but the skull bones were thin in both patients, particularly in the mother.

As Paget's is a biphasic process, absorption and bone formation going on equally in most patients, we occasionally see in the early stages only one phase, either absorption or bone formation. In this "monophasic" Paget's the most frequent appearance is localized osteoporosis and that nearly always in the skull, a roentgen appearance long known only as "osteoporosis circumscripta," now known to be an early stage of Paget's disease. The bone is not destroyed in the involved areas, merely demineralized, and later it is thickened with islands of bone formation scattered through it eventually after some years producing the cotton-wool appearance of a full-blown Paget's disease. Only rarely do we see the productive phase alone. This is usually in the end of a long bone, and all architecture may be lost due to increased calcium deposits, producing a chalky amorphous appearance. Again after several years the replacement process will produce the typical coarse trabeculae and thick but soft cortex so characteristic of the disease.

Spontaneous or pathologic fractures with but slight trauma are common in Paget's disease, as in these patients. Elevation of the alkaline phosphatase is

also common in Paget's disease, particularly if many bones are involved. However, we have not seen the marked ballooning of the bones with the appearance of multiple cysts as in the case of the mother (Figs. 6 and 7), and, as far as we now know, there is no hereditary or familial tendency in Paget's disease. The complete absence of similar changes in the pelvis, spine, and skulls of both patients is also against this diagnosis, as the most frequent point of involvement is found in the sacrum, innominate bones and vertebrae. We felt, therefore, that we could rule out Paget's disease in these patients.

4. Osteitis fibrosa cystica or hyperparathyroidism produces diffuse osteoporosis and variable localized cysts or giant-cell tumors. This disease is due to a hyperfunctioning adenoma of the parathyroid gland and the most reliable method of confirming the diagnosis is the changed blood chemistry. The blood calcium is almost invariably elevated while the blood phosphorus is lower than normal. In our patients the levels of calcium and phosphorus in the blood were within normal limits. Many patients with hyperparathyroidism have renal calculi, but none were found in these two patients. There is no familial or hereditary tendency in osteitis fibrosa cystica, but it would be quite possible to find two members of a family suffering from the same rare disease. While many of the bones in both of these patients appeared thin and somewhat deficient in calcium, they did not present the coarsely granular, porous and somewhat sievelike appearance usually seen with hyperparathyroidism. While we were unable to rule out this disease from the x-ray films alone, the clinical and laboratory findings made it highly improbable.

5. Polyostotic fibrous dysplasia is of unknown etiology and masquerades under many names and under many different classifications. One form of it, predominantly unilateral, and associated with precocious sexual development and pigmented cutaneous areas, has been described by Fuller Albright and is frequently known as "Albright's disease." There are no common clinical or laboratory findings, no abnormal blood chemistry, and no characteristic x-ray appearances. This disease is probably not a clinical entity and it may not be a single disease or condition, but rather a heterogeneous group in which are placed peculiar developmental abnormalities of the skeleton which may be due to inherent defects in the mesenchymal *anlage*. Many of the reported cases show enlarged, multicystic, bowed and badly deformed bones similar to the humerus and fibula shown in Figs. 6 and 7. In many of the cases, however, there is a suggestive, almost characteristic, thickening of one or both frontal bones, extending onto the roof of the orbit, with a loss of the normal differentiation between skull tables and diploe. Histologically this disease shows replacement of bone by fibrous tissue which may again turn into bone, and from the x-rays and the biopsy these patients might be classified under this heading. However, no hereditary tendency has been shown in any of the reported cases as far as we have found. The x-rays of the skull in our patients showing thin finely granular bones without localized areas of thickening and without cystic degeneration are against the diagnosis. We are unable, however, to rule out this condition from x-ray examination, clinical and laboratory findings, even from biopsy, but we think our patients fit better into the next group.

6. Fragilitas ossium (osteogenesis imperfecta). This condition is also probably not a single clinical entity. Most of the reports deal with the congenital type, in which all of the bones are very thin, very fragile, and there are numerous fractures, often at birth or presumably intrauterine. The skulls of these patients are nearly always deformed, the vertebrae usually present a "fish-bone" appearance or spool-shape, and the long bones are very thin with widening of the epiphyseal ends. There is no overgrowth of the cortex as there was in both of our patients, no diffuse cystic changes, and no hereditary or familial tendencies have been reported. This congenital type should be called "osteogenesis imperfecta" and the latent or adult type in which there is a very definite hereditary tendency should be called "fragilitas ossium" as suggested by J. Albert Key (1926). In the adult cases there are hereditary deafness, blue sclerae, and multiple bone lesions with frequent fractures from minor trauma. In fact the hereditary familial character in our patients and in their family is the deciding factor in classifying them under the heading of "fragilitas ossium." Without these factors they might better be listed under "polyostotic fibrous dysplasia" or one of its many pseudonyms, as the recorded descriptions of "fragilitas ossium" emphasize thinness of the bone and calcium deficiency with multiple fractures, rather than fibrous replacement of bone and cyst formation.

It is obvious from the above that these patients are on the borderline between polyostotic fibrous dysplasia and fragilitas ossium, and no certain or exact classification can be made from the x-rays alone or, in fact, from all the clinical and laboratory findings without the history of an hereditary skeletal dysplasia associated with familial deafness.

Dr. Bennett reviewed the biopsy material from the fibula and furnished the following report:

Microscopic Description.—The section shows varying sized and irregular spicules of bone without any definite architectural pattern. Nearly all spicules are surrounded by or covered on one side with hypertrophied osteoblasts. There are also scattered osteoclasts occupying some of the numerous indentations (Howship's lacunae) on the surfaces of the trabeculae. Occasional osteoclasts are observed to be in the cellular fibrous tissue of the marrow away from the bony margins. A few of the giant cells are extremely large and one of them contains nuclei undergoing mitotic division.

All of the intertrabecular spaces are filled with fibrous tissue that is moderately cellular and vascular. There is no significant inflammatory cell infiltration.

Owing to the technique employed in decalcifying the specimen, it is not possible to determine the degree of calcification of the bony matrix. However, the staining qualities of the mtarix and the morphology of the cellular components suggest that much of the bony tissue is recently formed and incompletely calcified.

An interpretation of the observed changes is difficult. Osteitis deformans (Paget's disease) and neoplasm can be ruled out as diagnostic possibilities. The clinical, roentgenologic, and pathologic features of this lesion enable one to dismiss osteomalacia and localized osteitis fibrosa cystica from consideration

in this instance. Since there appears to be a hereditary factor in the present case and since the predominant changes in the osseous lesion consist of accelerated but imperfect bone formation and active lacunar resorption with resultant fibrous tissue replacement, the descriptive diagnosis of hereditary fibrous dysplasia of bone seems justified.

Diagnosis.—Hereditary fibrous dysplasia of bone.

Dr. Thoma: This is a case of unique dental pathology. As already pointed out, it resembles in some respects idiopathic resorption of the tooth (Thoma, 1941); it differs in the following points: 1. There are more teeth involved than in any other case reported; 2. The transformation of tooth (dentine and cementum) into osteocementum has in some of the teeth progressed farther than ever seen before; 3. The osteocementum laid down, though trabeculated, is much denser than seen in ordinary cases of idiopathic resorption; and 4. The teeth have retained their individuality, being surrounded by connective tissue which separates them from the adjacent bone. This is an unusual feature because in some of the peripheral types of idiopathic resorption (Thoma, *Oral Pathology*, Fig. 524) the bone trabeculae of the adjacent spongiosa are continuous with the osseous structures replacing the resorbed dentine in the tooth.

The thought at once comes to one's mind that the resorption of these teeth may be a projection of the process normally affecting the deciduous dentition to the permanent one. Therefore a comparison of the two processes should be made. The purpose of the process of resorption of the deciduous teeth is their elimination. The resorptive process, therefore, is the main feature; it overshadows completely slight efforts at apposition of new tooth tissue. We do not know what starts the resorption of the deciduous teeth, except that somehow it is related to the development and replacement by the permanent successors which gradually encroach on their roots. However, in cases in which the permanent tooth fails to form, the roots of the deciduous tooth resorb just the same, only much more slowly. Thus we cannot find a causal relationship of the resorption of the deciduous tooth and that of the case in hand. Let us compare next the histologic appearance of the two resorptive processes. The physiologic process on the temporary tooth appears to be a gradual peripheral resorption restricted to the root surface which shows an indented condition caused by the numerous Howship's resorptive lacunae containing osteoclasts. Occasionally there is apposition, the product of which is soon again resorbed. The resorptive process only rarely extends beyond the surface and resorptive channels such as are seen in this series do not occur if the deciduous tooth is normal.

If the deciduous tooth is diseased, however, the picture changes completely. A deciduous molar in my collection, the roots of which had not been greatly diminished in size, and which was affected by extensive caries in the crown and had a necrotic pulp, shows an entirely different picture from that seen in the normal tooth. Resorptive channels containing inflammatory granulation tissue extend from the surface deep into the dentine, and it is interesting to note that in spite of the marked inflammatory reaction there is considerable apposition, especially in the resorptive areas at the surface of the root. Thus

we see that infection or necrosis of a tooth greatly accelerates resorption, the apposition however is in no way comparable with that seen in our case.

Transplanted teeth are subject to resorption. Deciduous teeth excised from young dogs were transplanted between the muscles of the abdominal wall by Huggins and McCarroll (1934). The pulps had been removed so that the teeth contained no viable tissue. The investigators found that the calcified dental tissue became encapsulated by connective tissue, and that in "many places a narrow strip of bone replaced the margin of dentine," which had resorbed. The transplantation to the jaw of permanent teeth which have had the pulp removed and have been sterilized also is followed by resorption. This has been demonstrated by Gottlieb and Orban (1931) on dogs, and observed by many clinicians who have replanted or transplanted human teeth. The roots of such teeth resorb in five to ten years almost completely. The only deductions we can draw from these findings are to the effect that teeth are resorbed if the viability has been impaired, and that in such cases the attempt at repair is of minor proportion. It is evident that the impairment of the viability in the disorders so far described is due to local causes, such as infection and necrosis of the tooth, or disconnection from its surroundings, depriving it of its normal metabolism. It is of course possible that the viability of a tooth, or more likely of all the teeth, may also become impaired by some internal disturbance. Kronfeld (1939) described two cases of generalized root resorption; in one, published by Mueller and Rony (1930), several intact permanent teeth had undergone extensive resorption of the root over a period of two years. The patient was an 18-year-old female who had suffered from a disturbance of liver function. In the other case, published by Gottlieb (1923), practically all the teeth showed superficial resorption, with reparative processes occurring in some instances. This case was that of a man 22 years old, who had died of influenza. Becks (1936) reported root resorption in patients with hypothyroidism, and also demonstrated that this resorption ceased with thyroid medication.

All this sums up to the fact that the teeth resorb if their metabolism is altered, and that this alteration may be caused by infection or interference with the nutrition (blood supply), or by systemic factors altering the metabolism of the entire body. Teeth may be more readily affected than other tissues by systemic factors because they have no collateral circulation, and because of the inadequate disposition for nutrition of the calcified structures.

All these disorders in which the teeth have been found to undergo resorption are, however, cases in which resorption is the primary pathology; apposition plays only an insignificant role. In the patient under discussion the replacement by trabeculated osteocementum is a feature, if not the main characteristic, of the disorder. It is a case of resorption of highly specialized type of intercellular substance with replacement by a tissue of inferior quality.

In addition to this replacement of the normal tooth structure by tissue of inferior quality there is also a change seen in the morphology and function of the dentogenetic cells lining the pulp canal. In the crown of the teeth we see normal cylindrical odontoblasts; rootward there is a gradual regression until flat cells appear; these produce again osteocementum instead of tubular sec-

ondary dentine. The pulpal apposition thus shows a gradual change of tubular to less tubular dentine and finally to an atubular osseous substance, osteocementum.

In regard to the pathogenesis of the dental disorder seen in our patient, it is easier to point out negative than positive factors. (1) The disorder is definitely not a malformation; the teeth were formed normally and then a process of resorption started, followed by repair. (2) We may say that its onset and progress have no relationship to the chronologic development or process of shedding of the teeth. (3) It can be definitely stated that occlusal trauma is not a controlling factor, because the mandibular incisor, distinctly in traumatic occlusion (Fig. 1), shows less resorption than some of the other teeth. (4) Caries and its sequel, pulpitis and pulp necrosis, are not causative factors, nor is there any evidence that the disorder started from the pulp. In contrary, many of the sections show how the pulp has protected itself by the deposit of secondary dentine or its equivalent (Fig. 15).

The relationship to the skeletal disease is difficult to evaluate, particularly because the latter is a bone dystrophy of undiscovered etiology. The teeth present changes resembling those seen in cases of Paget's disease, except that there are no marked contour lines in this disorder which give the so characteristic mosaic pattern of the bone trabeculae in Paget's (Thoma, *Oral Pathology,* p. 900). This is due to the fact that in these teeth apparently only the old dentine incited the mechanism of removal; the newly formed osteocementum was tolerated. Evidently the body was unable to maintain the most highly developed mesenchymal tissue, dentine, and replaced it by an inferior substance.

It should be noted that bone is a temporary tissue which constantly undergoes resorption and apposition, and that many systemic conditions, physiologic or pathologic, may accelerate either of them very easily. The mesenchymal hard tooth structures, however, are much more permanent tissues, and unless diseased, are not resorbed, though they have the power of repair through activation of their genetic cells (odontoblasts and cementoblasts). When we consider that in hyperparathyroidism which causes very marked resorption of the bone to liberate mineral salts, the teeth are not affected although the alveolar bone surrounding them may show active participation (Thoma, 1936), it is all the more difficult to perceive the pathogenesis of this condition, because here we have a case in which the teeth have undergone resorption of major proportion.

The interpretation of these facts leads to the conclusion that in hyperparathyroidism, a disease affecting the mineral metabolism, the teeth, being permanent depositories and not reservoirs of calcium, are not affected, but that the same mechanism as that evoked in bone resorption may be set in motion for some other reason to resorb the teeth. A collateral observation may be made in connection with this resorptive process in teeth which concerns the genesis of osteoclasts. While it is not possible to throw any light on whether osteoclasts are of endothelial origin or formed from a congregation of wandering cells, it is certain that they do not result from the accumulation of liberated bone corpuscles, as there are neither bone corpuscles (enclaved osteoblasts) nor odontoblasts normally present within the primary dentine substance of the tooth (Fig. 30).

SUMMARY

Unique dental pathology has been reported in a case of hereditary fibrous osteodystrophy, which was thought consistent with some stage of fragilitas ossium. Ten teeth were studied all of which showed extensive resorptive processes affecting primarily the dentine, but also involving the cementum. This resorption which in some instances removed almost the entire root of the tooth, was repaired by trabeculated osteocementum causing a complete change in the histologic appearance of the tooth.

Two interesting conclusions can be drawn from the histologic study of these teeth. The first is that teeth may resorb in a similar way as bone, and therefore the fact that they are not involved in hyperparathyroidism is not because they are immune to resorption. The second conclusion concerns the genesis of osteoclasts. The fact that osteoclasts appear in dentine which contains no enclaved cells should disprove the theory that they are a conglomeration of liberated bone corpuscles.

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AN UNUSUAL CASE OF DISCREET MILIARY CALCIFICATIONS OF THE CHEEK PROBABLY ARISING AS A RESULT OF ACUTE PAROTITIS COMPLICATING ECLAMPSIA

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THE patient, I. A., was a Negress, aged 50 years, married, born in British West Indies. During routine study of a full mouth series of radiographs prior to construction of artificial dentures, we observed in both cheeks, of this patient, diffusely scattered, small, discreet radiopaque bodies up to about 1 to 2 millimeters in size.

History.—Sixteen years previously, in the sixth month of pregnancy, patient was admitted to the Presbyterian Hospital complaining of constipation, headache, dyspnea, and epigastric pain. Her blood pressure was 162/100 and urine examination showed a heavy trace of albumin (4 per cent by acetic acid test).

Physical examination at that time revealed sclerosis of both retinal and brachial arteries, and cardiac hypertrophy with tic-tac rhythm indicating a mild arteriosclerosis of long standing.

During the first week, her blood pressure was constant at about 170 to 180 systolic and 100 to 110 diastolic. Albuminuria increased progressively. Blood count showed moderate anemia. On the eighth day, blood pressure rose to 198/114. Conjunctivae showed a slight icteric tint. Mucous membranes were dry. Reflexes were slightly hyperactive. Uterus was somewhat irritable. Patient complained of headache and was unable to eat.

At this time induction of labor was attempted by means of castor oil, quinine, and two enemas. Headaches increased and patient became restless. The urine specimen for that day boiled solid with albumin. Fluid intake was 540 c.c., output 390 c.c. Patient became slightly irrational, complained of severe headache and photophobia. The next morning she was semicomatose but rational when aroused. Knee-jerks were exaggerated. Blood pressure was 210/120, sclerae were slightly icteric. Output of urine was very little. Patient developed a typical eclamptic convulsion. Pulse was extremely rapid and of poor quality. She was given morphine and paraldehyde intravenously. A cesarean section was performed.

Following this operation, patient's pulse continued rapid and weak. She was semicomatose, and restless. Blood pressure remained about 200 systolic for three days. She complained of much blurring of vision. Patches of exudate appeared in the retinae.

During the first postoperative day the patient developed an acute parotitis; cheeks, tongue, and throat were markedly swollen, and she had difficulty opening her mouth. The abdomen was distended, respirations were labored, and her condition generally was poor. She was given 15 c.c. of 10 per cent magnesium

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sulfate intravenously with no apparent immediate effect. Later, however, her condition improved greatly and on the second postoperative day she began to have diuresis with relief from distention. She continued to improve although puerperium was further complicated by cystitis. Patient was discharged in good condition on the twenty-sixth postoperative day. Her blood pressure returned to 128/90.

Although patient had a moderate degree of chronic arteriosclerosis throughout, the whole course and development of her symptoms were like those usually associated with acute eclampsia.

Radiographic Examination.—Intraoral radiographs taken one year later revealed evidences of beginning calcific depositions in patient's cheeks (Fig. 1). Films taken thirteen years from this time showed marked depositions in both cheeks (Fig. 2). Fig. 3 is a film of the right cheek taken in January, 1942, or sixteen years after onset of eclampsia and parotitis, showing increased depositions.



Fig. 1.—Intraoral radiograph of maxillary left bicuspid-molar region showing evidence of calcified particles in cheek. Mag. ×4. This x-ray was taken about one year after episode of eclampsia and accompanying parotitis.

Radiographs of the maxillary and mandibular bones were negative in all instances. X-ray plates of the entire body, taken for the purpose of discovering like deposits elsewhere, showed no other soft tissues thus affected.

Current Oral Examination.—Patient is edentulous; mucous membranes are normal; bone contours are of moderate height. The cheeks appear normal with no scars, fistulae, lesions, etc., observable. Manual examination revealed no palpable bodies. Patient had no complaints.



Fig. 2.—Intraoral radiograph taken thirteen years after that shown in Fig. 1. Shows evidence of increased number of calcified particles in cheek. Mag. ×4.



Fig. 3.—Intraoral radiograph of cheek taken two years after Fig. 2, or sixteen years following original disease episode. Shows the miliary calcifications diffusely scattered. Mag. ×2.

Microscopic Examination.—A section of the inner surface of the right cheek was taken to a depth of one centimeter.

Microscopically, the *epithelium* appears normal. The *connective tissue* is divided typically into two layers: (1) the papillary layer bordering the epithelium, composed of short, intertwining collagenous fibers; and (2) the reticular layer composed of thin, loose elastic fibers forming a lattice-work arrangement and extending up to the muscle portion of the cheek. Large fibroblasts are scattered throughout. Numerous capillaries are seen. The walls of the smaller blood vessels are thickened up to several times their normal size.

The portion of the papillary layer immediately beneath the epithelium appears degenerative. The connective tissue fibers are granular, edematous, and present numerous vacuoles.

Scattered throughout the lower portion of the papillary layer, and between this and the reticular layer, are the small discreet areas of apparent calcification. These masses take a pale hematoxylin stain and present lines much like cracked pavement. No osteocytes are present nor are there any other similarities to Haversian systems. (Fig. 4). Special stain (von Kossa) showed these areas to be calcified.

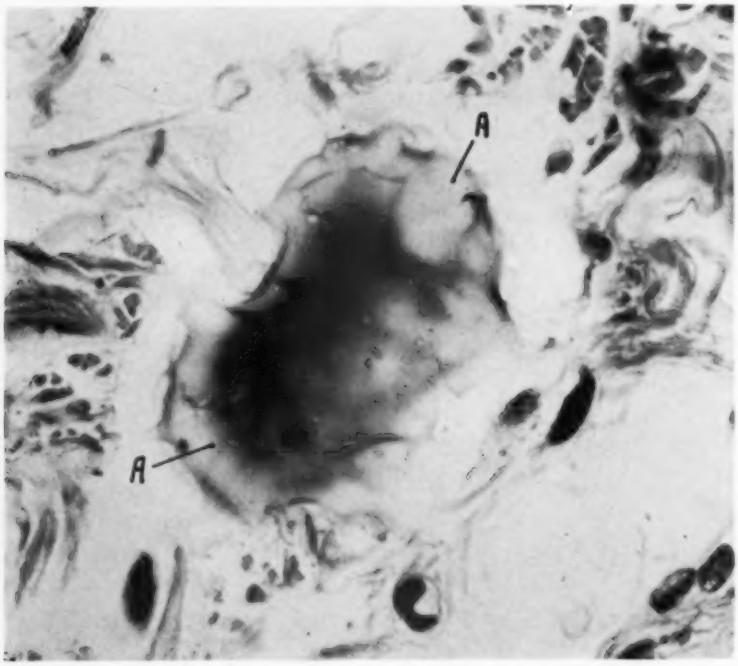


Fig. 4.—Photomicrograph of section from inner surface of cheek. Hematoxylin-eosin stain; Mag. ×1010. Shows calcified mass between papillary and reticular connective tissue layers. *A*, Calcified mass, 0.7 mm. in diameter, giving an appearance much like cracked pavement.

DISCUSSION

Ossification of tissue may take place at many points throughout the body if degenerative changes and deposition of calcium salts occur. Thus, injuries to muscles, fasciae, and other soft tissues and inflammations of various sorts seem capable of giving rise to a change which finally leads to lime salt depositions followed, in some cases, by bone formations. Examples may be found in such

conditions as arthritis deformans, progressive myositis ossificans, and the calcified tubercles of tuberculosis. These are not regarded as tumors since they seem to be merely an osteoplastic healing process which follows upon injury to the tissues.

It is also known that tissue which becomes encrusted or impregnated with gritty particles of lime is usually degenerated. The basis for such deposits then is necrotic tissue or, at least, pre-existing inflammatory processes. Thus, it is common to find calcified plates, spicules or stonelike masses in areas where the circulation has become deficient.

Our case appears to fall in the latter category. The depositions are calcified as evidenced by the microscopic and x-ray appearance and by the positive von Kossa stain. The history of eclampsia with acute parotitis suggests a possible cause. The sudden and marked swelling accompanied by the fever and trismus may have reduced or shut off temporarily the blood supply to a large number of areas. Necrotic tissue may have formed as a result of the sudden, decreased vascularization and in turn acted as organic nuclei or nests preceding the lime-salt deposition. Although we did not have x-rays previous to the eclampsia and parotitis, the fact that the films, taken about one year after the presence of these affections, show small deposits of lime salts as compared with subsequent films suggests that the process may have begun with the eclampsia and parotitis. We have never observed a case of this type before, nor have we been able to find a report of such a case in the literature.

Diagnosis.—Miliary calcifications in the cheeks.

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AMELOBLASTOMA

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AMELOBLASTOMA is a tumor arising from enamel-forming cells or epithelial rests, both of which are derived from buccal epithelium. Many other terms have been used to designate this tumor, the more common ones being: adamantinoma, adamantoblastoma, multilocular cyst, adamantine epithelioma, cystoma, and others. The term adamantinoma, although a misnomer, has been so universally adopted that it will be very difficult to discard and there is little to be gained by insisting on the use of the more correct term—ameloblastoma. Either term may be referred to in the following discussion.

All variations of epithelial cells between stratified squamous and adult ameloblasts may be seen, recalling the development of the enamel organ. Columnar cells resembling ameloblasts may be seen surrounding the stellate reticulum—hence the name, ameloblastoma. Ewing and Thoma have both described a number of histologic variations.

Considerable space has been given in the literature to a discussion of the origin and pathology of ameloblastoma. It is hardly necessary to do any more than briefly mention here the important theories on origin. Broca felt that ameloblastoma arose from the dental germ, and Falkson decided it had its origin in additional, that is surplus, tooth germs. Buchtemanz's theory stressed the origin as being from the mucous membrane or from the glands of the mouth. This theory attracted considerable support. Malassey stated that this tumor arose from groups of cells about the roots of teeth—these groups being called epithelial debris. This theory is the most widely accepted at present.

LOCATION

Ameloblastoma, although a comparatively rare tumor, is seen most often in the jaws. It occurs more frequently in the molar region of the mandible, but may appear elsewhere in the lower jaw. It is far less common in the maxilla. A number of cases of pituitary adamantinoma have been reported, which have the same structure and origin as those in the jaw. Ameloblastoma also occurs in the tibia, where it has been observed on several occasions.* There are two schools of thought regarding the origin of this tumor in the tibia. One group feels that a fragment of epidermis may be included in the tibia because of embryonic malformation. The other groups feel that it arises from skin epithelium implanted at the time of an injury. In either case, the epithelium probably becomes differentiated into modified ameloblasts and is stimulated to develop an ameloblastoma either from trauma or from an unknown cause.

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*After this paper was written, the first case of adamantinoma of the ulna to be reported was presented by Anderson and Saunders in the September, 1942, issue of *Surgery, Gynecology and Obstetrics.*

More men seem to favor trauma as an inciting factor. McFarland and Patterson, in a review of the literature, mention one case of ameloblastoma involving the upper lip which was not attached to the maxilla.

SIGNS AND SYMPTOMS

Ameloblastoma is a disease of early middle life, rarely appearing before the fourth decade. Patients afflicted with this disease seldom complain of any symptoms other than a slowly progressive, painless tumor of long standing producing, perhaps, facial disfigurement. If it should become infected, the corresponding signs and symptoms of osteomyelitis may present. One of our patients (Case 3) complained primarily of soreness, which was the result of trauma during mastication. Another (Case 2), developed moderate hemorrhage from the tumor on several occasions, this being incited by mastication usually.

Because of the lack of symptoms, most patients will not present themselves for treatment until several years after the onset. By this time, the tumor has attained a very large size in most cases. Some clinics may see patients earlier because of the wider use of x-rays on examination and because of attempts to make the public tumor conscious. Most of the cases we have seen have been well advanced.

During the early stages of development, the ameloblastoma may be seen only on x-ray examination as a multicystic tumor within bone. If the tumor should be solid, early diagnosis may not be easy. As the ameloblastoma continues to develop, it will expand the buccal and lingual plates and will bulge out from the alveolar ridge. The cortical plates are gradually lost, the entire section of the mandible is replaced by this abnormal tissue, and the tumor continues to expand and push aside the surrounding tissues. The patient may still complain of nothing other than a large, painless tumor and a facial deformity.

In the maxilla, there is a tendency for ameloblastomas to invade the antrum, nasal fossa, and orbit. The growth may or may not bulge out from the alveolar ridge, forming a large tumor projecting into the mouth cavity. A very few cases of intracranial extension have been reported.

The solid ameloblastoma becomes cystic through degeneration of the epithelial elements. Most of these tumors are multicystic when they are presented for diagnosis and treatment. However, the solid type may attain a large size before cysts appear within it. As the cysts expand, the septa between them are gradually destroyed forming larger cystic cavities. Within these cavities is a clear or brownish-tinged viscous fluid.

The surface of the tumor may be smooth or slightly lobulated and is usually covered with normal mucous membrane. The membrane may have been traumatized during mastication and occasionally the tumor will be drained spontaneously. On palpation, it will feel soft or fluctuant where the bony wall has been lost and crepitant where the bony wall is thin. If the tumor is solid, it will feel hard.

DIAGNOSIS

Occasionally, the diagnosis of ameloblastoma cannot be made prior to operation. In such a case, the diagnosis may be made or suspected at operation and substantiated afterwards by microscopic examination. In most instances, a correct preoperative diagnosis can be made from the history, clinical and x-ray

findings. A patient about 30 years of age or older will give a history of having a slowly growing, nonsymptomatic tumor of long standing. Most likely, the tumor will be bulging from the molar region of the mandible and pushing the surrounding tissues aside. In most cases the teeth will be absent in this area. Since the tumor is usually multicystic x-ray diagnosis is made easier. There will be many cystic cavities of various sizes with definite borders. The septa between the cysts will be intact, or partly or wholly lost. When the septa are lost, forming a larger cyst, the wall occasionally suggests an ameloblastoma by its lobulated appearance. There may, also, be small accessory sinuses in the bone adjacent to the large cystic cavity. In making a diagnosis, we should keep in mind the possibilities of osteitis fibrosa cystica, osteogenic sarcoma, myxofibroma, and benign giant-cell tumor. Regardless of the preoperative findings, the specimen should be submitted to the pathologist for a confirming diagnosis to safeguard the treatment and the patient's record.

TREATMENT

There is no absolute uniformity in the treatment of these patients. That is to be expected because of the variations in each case and in the individuals caring for these patients. Science will suffer when all men agree. Nevertheless, there has developed a uniform opinion that these tumors must be treated radically, and rightly so. Whatever method of treatment is employed, it must not only destroy the tumor mass, but also its ramifications into the surrounding bone. Local curettement is prone to fail as exemplified in Case 1. A few men do a local curettement and then implant radium into the cavity. We have had no experience with that form of treatment. X-ray is of no value for the tumors are radioresistant. If enough x-ray is given to be lethal, a radiation necrosis will usually follow and this lesion is more difficult to treat than the ameloblastoma. New and Havens suggest surgical diathermy in selected cases and this is a worth-while method. The tumor is coagulated and the surrounding bone is cauterized for a depth of 0.5 cm. During the two or three months required for sequestration, new bone is formed which will maintain the function and continuity of the jaw. If the growth can be diagnosed early enough, the lesion might possibly be removed and the surrounding bone saucerized for a distance of 0.5 cm. Because of its central origin and the lack of symptoms as described, this form of treatment is seldom practical.

Resection of a portion of the mandible is indicated in most cases, at least all of those in which the tumor has attained an appreciable size or has perforated the cortical plates. The mandible should be sectioned at least 0.5 cm. on either side of the tumor. If it is a large, meaty growth, the external carotid artery should be ligated prior to operation. Following the resection, the edges of the stump should be made round and smooth with rongeurs to avoid the postoperative discomfort associated with soft tissues lying over a sharp edge of bone. A rubber drain is inserted in the wound, because it is necessary to open into the mouth cavity in removing the large tumors.

At the time of operation or shortly afterward, the teeth on the opposite side of the mouth, if present, are held in occlusion by some simple means of intermaxillary wiring for a period of two to eight weeks. This not only helps to maintain a better airway, but holds the residual portion of the mandible in its normal relationship to the maxilla. When the wires are

removed, the mandible will move toward the resected side, but as soon as the muscles of mastication regain strength, the mandible will be held in good position. Mastication and nutrition can be maintained, although the patient will have some difficulty in incising. There will be a period of temporary soreness of the temporomandibular joint, after the wires are removed, because of the strain on the joint until the muscles have regained enough strength to hold the mandible in good position.

A relatively large section of the mandible can be removed without seriously disturbing function or disfiguring the patient. The ascending ramus can be removed with almost no disfigurement or disturbance of function. Resection of the ascending and horizontal rami as far forward as the mental foramen will produce only a slight inward sag of the soft tissues in the region of the angle. There may be a temporary speech defect because of the loss of sensation and temporary control over half the lower lip. Mastication and nutrition can be maintained, but there is some difficulty in incising.

With resection of half the mandible, there is a noticeable facial disfigurement resulting from the inward sag of the soft tissues on the affected side and the prominence of the stump at the symphysis. If the remaining half of the mandible is displaced toward the midline, a slight fullness of the soft tissues may develop in the molar region of the resected side, as seen in Fig. 9. Speech is altered because of loss of teeth, loss of control temporarily over half the lower lip, and the disturbance of the anterior muscle attachments of the tongue. Swallowing may be slightly difficult for a few days. Within several days, speech will return to that of an edentulous person, and nutrition can be maintained satisfactorily.

When the entire symphysis is lost, a marked deformity is produced. The anterior attachments of the tongue are lost and the jaw collapses, crowding the tongue. Speech and swallowing are both affected, and nutrition for a few days will have to be partially maintained by parenteral feedings. Reconstructive surgery is mostly indicated when the symphysis is lost.

SUMMARY

Ameloblastoma, or adamantinoma, is a locally malignant tumor that is seen most often in the molar region of the mandible after the third decade of life. It is a nonsymptomatic, slowly growing tumor which must be treated radically to prevent recurrence. In most cases, resection of a portion of the mandible is the treatment of choice. A large section can be removed, provided the symphysis is not involved, without producing any serious functional disturbance or facial disfigurement.

Case 1.—A. S., an obese, white female, aged 41 years, presented herself at the outpatient clinic in the George F. Geisinger Memorial Hospital on Sept. 17, 1940. For three months prior to this time, she had intermittent neuralgia pains in the mandible on the right side, these being referred to the right ear. One month after the onset, two lower right molar teeth were extracted with no relief. Since that time, she has had a slowly progressive tumescence developing in the lower right molar area. Three weeks before admission, the patient had an x-ray taken elsewhere with the diagnosis of ameloblastoma being made. She was then referred to this clinic for treatment.

The patient's past history and general physical examination were essentially negative. Urine and blood analysis, bleeding and clotting times, and serologic examinations were negative.

Examination.—On examining the patient, it was noted that there was no facial deformity. The mandible on the right side was edentulous posterior to the first bicuspid. In the molar region, there was a firm, nontender tumescence of the jaw with the buccal and lingual plates expanded outward. The tumor was covered with normal mucous membrane and did not invade the surrounding tissues. Other than an artificial maxillary denture, the rest of the examination revealed nothing.

X-ray examination is as follows: There is a multilocular cystic area in the right mandible, extending from the first molar area posteriorly to about 2.0 cm. behind the third molar area. It occupies the entire jaw and has produced expansion in both vertical and lateral directions. The edges are quite sharp, and there is a small amount of periosteal reaction on the alveolar border of the tumor. The appearance is that of an adamantinoma.



Fig. 1, Case 1.—Lateral jaw x-ray showing the ameloblastoma in the lower right molar region of the mandible.

Treatment.—Considering the diagnosis and the extent of the tumor, we advised resection of a portion of the mandible. The patient refused this form of therapy, so we agreed to do a local curettement. On Sept. 18, 1940, under local anesthesia with morphine-scopolamine being given preoperatively, the mucoperiosteum was elevated and the tumor exposed. Within the ameloblastoma, various-sized cystic cavities filled with a clear viscous fluid were found. Although there were definite bony septa present, adjacent cysts communicated with each other. Every visible bit of the tumor was removed, leaving only the inferior cortical plate of the mandible to maintain continuity of the jaw. The

cavity was packed with vaseline gauze and the wound partially closed with silk sutures.

The patient had no postoperative discomfort and so was discharged the following day to the outpatient service. In view of the diagnosis, we strongly urged periodical x-ray examination. The patient cooperated very well with this request and returned every three months for x-ray studies.

On Oct. 13, 1941, one year later, recurrent adamantinoma on the anterior border of the ascending ramus was reported on her x-ray findings. We again advised resection and this time the patient consented, although it was not possible for her to undergo treatment until the following April. During the interim, x-rays were taken for the purpose of observation and the recurrent tumor enlarged to the size seen in Fig. 2.

On April 15, 1942, the patient was readmitted to the hospital. The next day, under intratracheal nitrous-oxide and ether anesthesia, the right mandible was sectioned at the mental foramen, anteriorly, and at the base of the condyle, posteriorly, and removed. A Penrose drain was inserted and the wound closed with buried chromic and cutaneous silk sutures. The entire condyle, which was sufficiently distant from the tumor, was left in place in case a bone graft was inserted later.



Fig. 2, Case 1.—Recurrent ameloblastoma in the ascending ramus following local curettement of the tumor in Fig. 1 one year previous.

As soon as the patient recovered from her postanesthetic nausea, the lower teeth were wired to the upper denture and the mandible was supported with a plaster bandage.

On May 26, 1942, the wires and plaster bandage were removed. Within a few days, the muscles of mastication had regained strength and the remaining portion of the mandible was held in good position. Her speech was normal, and there was very little facial disfigurement and functional disturbance.

Comment.—This case illustrates the tendency for ameloblastoma to recur unless radical treatment is carried out. In this case, the tumor recurred one year after local curettement during which all visible abnormal tissue was removed.

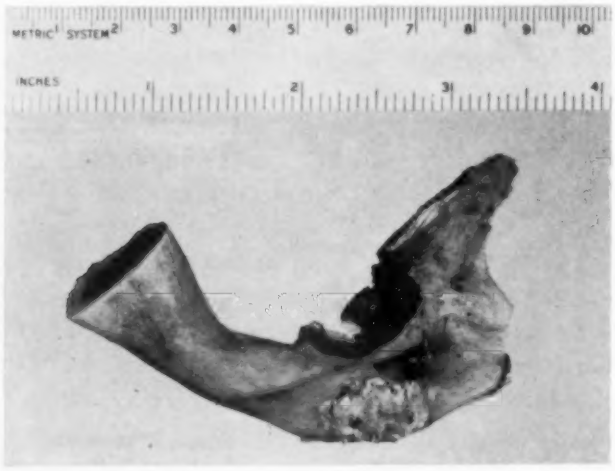


Fig. 3, Case 1.—Section of the mandible removed at operation. Medial aspect.



Fig. 4.



Fig. 5.

Fig. 4, Case 1.—Intermaxillary wiring used to hold the mandible in its normal position. The plaster bandage was used because the patient had an artificial maxillary denture.

Fig. 5, Case 1.—Appearance of the patient two months postoperatively. Note the satisfactory occlusion and facial symmetry.

Case 2.—W. G., a white male, aged 77 years, came to the clinic on May 6, 1942, complaining of a tumor of the lower jaw. Following the extraction of his lower teeth ten years previously, a tumor developed in the lower right first molar area. This tumor slowly increased in size, finally to become the large tumor seen in Fig. 6. This growth has been nonsymptomatic throughout its

development, except for a moderate amount of bleeding from the tumor on several occasions, usually incited by mastication. Because of the absence of teeth and the size of the tumor, it was always used during mastication. Of late, the patient feels that the rate of growth has increased.

Examination.—The patient had an asymmetry of his face due to a bulge at the symphysis and along the right horizontal ramus. On examining the mouth, we found a large tumor, measuring 7.5 by 5.5 by 4.5 cm., involving most of the symphysis and the right horizontal ramus. It was somewhat lobulated in appearance and was covered with a normal mucous membrane. There were many prominent blood vessels on the surface and in one small area, there was superficial excoriation which appeared to be due to trauma and from which the patient had some bleeding.



Fig. 6, Case 2.—Ameloblastoma involving the symphysis and right horizontal ramus. This is of ten years' duration.

Clinically, the tumor appeared to have destroyed all of the right horizontal ramus, its normal configuration being entirely lost. The soft tissues about the growth were displaced but not invaded. On palpation, the tumor was fluctuant in some areas and crepitant in others.

A tentative diagnosis of adamantinoma was made and this was confirmed by the x-ray findings, which were as follows: There is a large multicystic tumor of the right mandible, extending from the midline to the third molar region. The mandible has been completely replaced by the tumor from the canine to the first molar area. The growth, evidently, extends well into the mouth cavity. The appearance is that of an adamantinoma.

The general physical examination revealed a moderate arteriosclerotic and hypertensive heart disease with early congestive failure. In view of this, the internist decided it would be best to digitalize the patient preoperatively and



Fig. 7, Case 2.—X-ray examination of the case seen in Fig. 6. Numerous cystic cavities are still evident.

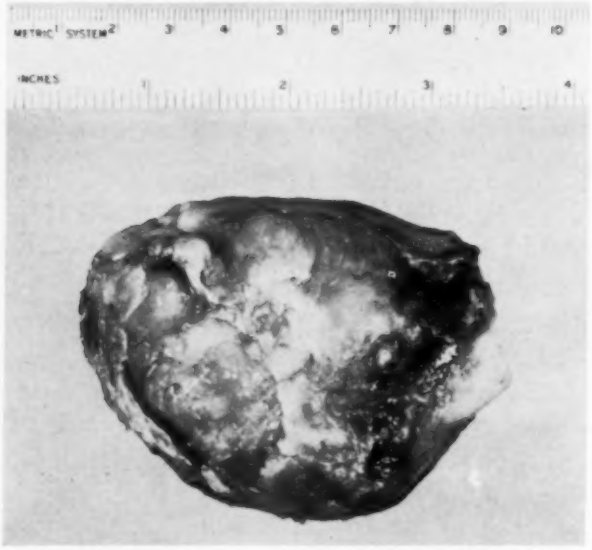


Fig. 8, Case 2.—Specimen removed at operation. See Fig. 6.

to carry him through part of the operation under local anesthesia. It so happened that we were able to complete the case under sedation and local anesthesia.

Treatment.—On June 6, 1942, under local anesthesia and sedation, the tumor and the mandible were exposed through an external approach. The jaw was sectioned 0.5 cm. anterior to the growth and in the lower third of the ascending ramus, which was sufficiently far out into healthy bone. The external carotid artery was ligated prior to removal of the ameloblastoma.

Within a few hours, the patient was taking a fair amount of fluids by mouth. Swallowing was slightly affected and the speech defect was marked. Within a week, he could handle a soft diet quite well and his speech had improved. On the thirteenth postoperative day, he was discharged from the hospital. There was, at that time, some facial disfigurement due to an inward sag of the soft tissues on the resected side of the chin and a fullness just anterior to the angle. Swallowing was normal and speech had returned to that of a normal edentulous individual.

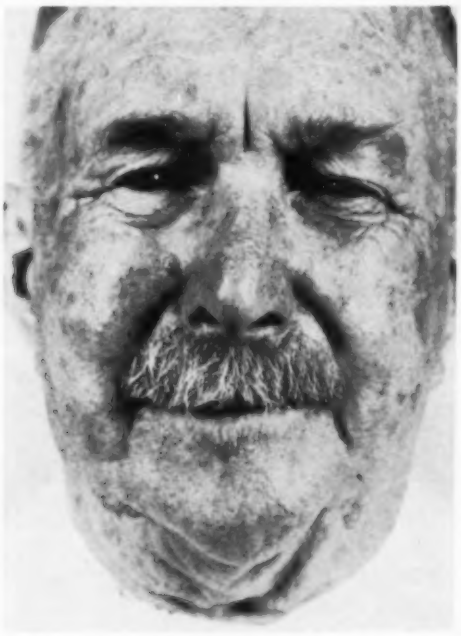


Fig. 9, Case 2.—Appearance of the patient one month after operation.

Pathologic Examination.—The diagnosis of ameloblastoma was confirmed by microscopic examination of the tumor. The report is as follows: This section has a typical appearance of adamantinoma. The parenchyma of the section is made up of various-sized units, which have an outer border of low columnar or cuboidal epithelial cells. Inside of this layer of cells are superimposed layers of cells which, in some instances, are obviously squamous epithelium. In other portions of the section, the central units are not so obviously squamous in origin.

Case 3.—A. W., a 62-year-old white female, reported to the clinic on Oct. 10, 1940, with a large tumor extending into her mouth from the right maxilla. One year prior to this time, the upper right first molar was extracted. A few days after the tooth was removed, she noticed a firm tumescence developing at

the site of extraction. It progressed steadily to the size seen in Fig. 10. The tumor has been nonsymptomatic throughout its course, although it finally became so large that she traumatized it on mastication producing localized soreness. At no time had she sought professional advice.

Examination.—On examining this patient's mouth, a large tumor measuring 5 by 4 by 3 cm. was seen bulging out from the upper right alveolar ridge. The growth was hard and nontender. It was covered with normal mucosa, although there was an area of excoriation secondary to trauma of mastication. The tumor was fixed to the jaw.



Fig. 10, Case 3.—Ameloblastoma involving the left maxilla. This tumor has been visible for one year.



Fig. 11, Case 3.—Appearance of the mouth one month after operation. See Fig. 10.

X-ray examination was of little benefit in this case. Laboratory studies and the general physical examination were both negative.

Ameloblastoma was suspected and this diagnosis was confirmed by a preoperative biopsy.

Treatment.—The tumor was removed under local anesthesia. The entire alveolus was involved and had to be resected. The floor of the antrum was barely perforated, leaving the membrane intact. The tumor extended well into the substance of the soft palate, but this was removed without creating a perforation in the palate.

Microscopic Examination.—Sections from this specimen are quite cellular with only a few areas composed of, what appears to be, hyalinized tissue. The cells are of the cuboidal type and have prominent pyknotic nuclei. In some areas they appear in the form of clumps and sheets while in other portions of the section, they tend to form cystlike structures. The picture is that of an adamantinoma.

Convalescence was uneventful, and there is no evidence of recurrence at the end of two years.

Case 4.—C. E., a 77-year-old white male, was referred here by his family dentist following an incision and drainage which failed to heal. Six months before he was admitted to the hospital (January, 1942), he developed mild pain in his left upper jaw. This was followed by a slowly progressive swelling of the upper left alveolar ridge. The family dentist did an incision and drainage and later referred him here. The patient stated that "pus" had been draining since drainage was established.

Examination.—An open wound, 2 cm. long, was noted on the buccal aspect of the upper left alveolar ridge in the first molar area. On probing, it appeared that the wound opened into a cystic cavity. There was a slight bulge of the upper left buccal plate. Other than the patient being edentulous, the rest of the mouth examination was negative.

X-rays of the left maxilla showed a multicystic tumor composed of various-sized cystic cavities. The tumor involved all the upper left alveolus, extending to the floor of the antrum and to the nasal fossa.

The general physical examination and laboratory studies were of little interest.

Treatment.—Under pentothal anesthesia, the mucoperiosteum was elevated from the upper left alveolar ridge, and the tumor was exposed. Many cystic cavities lined with epithelium and communicating with one another were noted. The floor of the antrum and the nasal fossa were perforated, but in each case the membrane was intact. The ameloblastoma was completely removed, with the excision being carried out into healthy bone. The wound was closed without drainage.

Diagnosis was confirmed by microscopic examination.

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DEGREE OF EPITHELIAL KERATINIZATION OF THE RIGHT MAXILLARY AND MANDIBULAR MUCOBUCCAL FOLD*

A Preliminary Report

Carl August Schlack, D.D.S.,† and Edward Neville Gardner, D.D.S.‡

INTRODUCTION

IN RECENT years a number of investigators, Orban,[1] Weinman,[2] and others, have made studies of the cellular elements of the saliva to attempt to ascertain if there could be some relationship between these cellular elements, especially the epithelial cells, and the susceptibility or immunity of certain mouths to carious or gingival lesions. They discovered that more information was needed concerning the superficial layers of the squamous epithelium of the mouth.

Studies of the epithelial cells of the mouth were made as early as 1886 by Severin,[3] who found keratinized cells on the tongue, and Miller[4] in 1890, who stated that the epithelial cells found in the saliva were dead cells sloughed off the mucous membrane of the mouth. Gottlieb[5] and Orban[6] had demonstrated that there was keratinization of the gingiva, and Weinman,[7] after making smears of the superficial layer of cells in different parts of the oral cavity taken from ten patients, claimed that there was a difference in the degree of keratinization of different parts of the mouth, with the palate exhibiting the highest degree, and other portions of the mouth in this order: gingiva, tongue, cheeks. In making comparative studies of a particular region in the mouth, Schlack, Wheatcroft, and Stead found in 178 smears taken from the gingival margins of 89 patients that in a majority of the cases there was more keratinization buccally and labially than interproximally.[8]

The method of making scrapings for study is used because it has the following advantages:

1. Each cell can be studied separately.
2. There is no injury to tissues of the mouth.
3. A minimum of time and equipment is needed.

With the Ernst-Gram method of staining used in this study, cells in which no keratin has formed are stained a light red, with a well-defined nucleus staining a darker red. In the first stages of cornification small particles of the nucleus are stained blue, and successive stages of the process show the entire cell taking the gentian violet stain from the nucleus outward, making it appear as if the nucleus was becoming larger. In the last stages the cell may be stained either all blue or all red, with no nucleus in evidence.

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NOTE: The opinions or assertions contained in this article are the private opinions or assertions of the writers and are not to be construed as official or reflecting the views of the Navy Department or the Naval Service at large. (Article 113, U. S. Navy Regulations.)

There are numerous conflicting theories concerning the exact process by which certain cells become keratinized. It is usually explained as the reaction of squamous epithelium to different stimuli and irritations and is considered to be a protective mechanism.

PURPOSE

This study is an attempt to find the proportion of cells that exhibit some sign of keratin formation in a particular maxillary region and compare this proportion to that of a corresponding region in the mandible.

PROCEDURE

The mucobuccal folds opposite the right third maxillary and mandibular molars and the folds opposite the right maxillary and mandibular canines were studied. Two methods of obtaining the smears were used:

1. The mucobuccal fold of the right maxillary third molar region was dried by a blast of air, and a scraping was made with a blunt, stainless steel, double ended instrument, and smeared gently on one end of a clean glass slide. Using the opposite end of the instrument, which was the same size and shape, the process was repeated on the corresponding area in the mandible, and this smeared on the opposite end of the slide.

This procedure was found to have the disadvantage of clumping the cells and often crushing them so that they were unsuitable for study. This procedure was abandoned for that to follow.

2. Two wire loops were used, one for the maxillary and one for the mandibular region. After the area was dried the loop was dipped in clean water, then rubbed over the area. The small droplets clinging to the loop were then smeared gently on the glass slide and allowed to dry by evaporation.

The slides were then marked and the age of the patient written on the slides with a stone.

After the smears were thoroughly fixed by drying, they were stained by the Ernst-Gram method:

SOLUTION I

Saturated alcoholic solution of gentian violet (Gruebler)	10 c.c.
5 per cent aqueous solution of phenol	90 c.c.

SOLUTION II (LUGOL'S SOLUTION)

Iodine	1 Gm.
Potassium iodide	2 Gm.
Distilled water	300 c.c.

1. Cover smears with solution I for 30 seconds.
2. Wash with water a few seconds.
3. Cover with solution II for 30 seconds.
4. Wash with 95 per cent alcohol until color ceases to come out of slides. (About two minutes.)
5. Wash with water 2 or 3 seconds.
6. Stain with safranin for 2 minutes.
7. Wash with water 2 or 3 seconds.
8. When slides are dry mount cover glasses with Canada balsam.

Microscopic studies of the slides were made and the same number of epithelial cells counted in both maxillary and mandibular smears. When possible,

100 cells were counted. At the same time, the number of cells in which some keratin could be seen and which were in the same fields were counted to get the proportionate number of these cells.

Forty-four smears of the third molar regions of twenty-two patients, and in addition, twenty-four smears of the mucobuccal fold of the right canine areas of twelve patients, procured by Dr. H. D. Ryan in a similar manner,[9] were studied.

RESULTS

I. Smears taken from mucobuccal folds of the third molar regions:

NUMBER OF SLIDE	AGE	KERATINIZED CELLS, MAXILLARY REGION	KERATINIZED CELLS, MANDIBULAR REGION
1	43	9	11
2	44	0	0
3	33	2	3
4	26	2	2
5	32	14	8
6	45	0	0
7	27	2	3
8	27	0	0
9	25	4	5
10	20	10	8
11	60	3	0
12	25	0	0
13	27	0	1
14	31	2	2
15	25	18	13
16	27	10	7
17	27	6	8
18	20	2	7
19	22	6	5
20	26	6	14
21	34	0	0
22	22	4	5
Total keratinized cells		100	102

Summary.—In 27.3 per cent of slides there were more keratinized cells in the maxillary smears; 40.9 per cent had more in the mandibular smears; 9 per cent were the same, and in 22.8 per cent of the slides, no keratinized cells could be found.

II. Results of smears made of right maxillary and mandibular canine regions of mucobuccal fold.

NUMBER OF SLIDE	AGE	UPPER SMEAR, K. CELLS	LOWER, K. CELLS
1	24	1	0
2	28	0	5
3	26	3	3
4	25	6	1
5	28	2	5
6	27	4	5
7	27	0	3
8	22	3	10
9	35	2	3
10	23	18	7
11	25	1	11
12	27	0	5
Total		40	58

Summary.—In 25 per cent of the slides there were more keratinized cells counted in the smear from the maxillary region, in 67 per cent more from the mandibular, and 8 per cent were the same.

CONCLUSIONS

As this is only a preliminary report, there can be no absolute conclusions, as a great number of smears would need to be made and cells counted to minimize error as much as possible.

However, on the basis of this work thus far the following observations might be noted.

1. There is very little keratinization of the mucosa of the regions studied. In most cases the cells counted were in the first stages of keratinization; that is, only a portion of the nuclear area and little of the cytoplasm were stained by gentian violet.

2. The age of the patient seems to be of no consequence as far as cornification of the mucosa is concerned.

3. Slides showing more epithelial cells in different stages of keratinization were those prepared from the mandibular mucobuccal fold areas. The difference between maxilla and mandible was more pronounced in the canine than in the third molar regions.

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SARCOIDOSIS OF THE JAW

A New Disease of the Mandible

David L. Poe, M.D., New York, N. Y.

IN SPITE of extensive studies of sarcoidosis of the skin, lungs, bones, glands, and other structures of the body, there is, so far as can be determined, no record of a description of sarcoid of the mandible.[1]

Since the jaw is one of the most exposed parts of the body, being subject to trauma, functional imbalance resulting from protrusion and inadequate support, infections, etc., it is difficult to assume that sarcoidosis which attacks the various organs and structures of the human organism would fail to involve the mandible.

It is, therefore, fair to conclude that lack of recognition of this disease is primarily responsible for its omission in the medical literature. It is hoped that this report will stimulate further search and description of this condition.

Although there has been considerable controversy as to whether sarcoidosis is to be regarded as a form of lymphogranulomatosis or as a type of tuberculosis it is generally agreed that this condition is a generalized or systemic disease; that is, it may affect any part of the body, that the various sarcoid lesions are expressions of a single pathologic process, that they produce an anergy to tuberculin, and that they do not by themselves cause caseation.

As seen on the skin or other superficial surfaces these lesions appear as disseminated, well-defined papular nodules and plaques. Histologically these nodules consist of "definite collections of epitheloid cells with pale staining nuclei, the masses being separated by connective tissue septa, within the meshes of which are a few giant cells and lymphocytes." The nodules contain vessels, but no elastic tissue. Caseation does not occur.[2] Similar nodules were observed in sarcoidosis of the external ear[3] and in the larynx.[4]

CASE HISTORY

A 41-year-old colored female complained of occasional shooting pain in the left ear and hoarseness first noticed about two years previously.

Past History.—Skin blotches were first observed about 18 years ago. These were preceded by nosebleeds. The patient also noticed nodules on the face and nose. She denied having had venereal diseases.

Family history is essentially negative.

Physical examination revealed a poorly nourished colored female. The skin of the face and extremities was covered with numerous nodules and plaques and also some scars. The nose displayed multiple discrete projections the size of poppy seeds, or tumorlike masses as large as peas. The interior of the nose

From the Department of Otolaryngology of the New York Post-Graduate Medical School and Hospital of Columbia University.

showed a mass composed of closely packed miliary infiltrations, resembling a raspberry. Although there was no ulceration this mass, as well as the nasal septum, bled very easily when touched with a probe.

There was a single infiltration on the upper lip and also one on the lower lip besides several plaques. The patient stated that she sometimes feels a boring sensation in the lips which is aggravated by eating and drinking. The mouth showed a chain of infiltrations of pinhead size.

Examination of the larynx showed the false vocal cords to contain numerous seedlike elevations and the arytenoid cartilage to be infiltrated, edematous, and nodular.

In the posterior wall of the trachea some pinhead thickened spots were noticed giving a sense of hardness when touched with a probe. The epiglottis was indurated and thickened. On the lingual surface was a large tumorlike mass. A bronchoscopic examination revealed tumorlike agglomerations deep in the trachea close to the bifurcation.

The arms and legs were covered with apigmented patches of indurated tissue having a rubbery feel.

Heart and lungs were negative; abdomen also was essentially negative. Liver and spleen were not enlarged. Reflexes were normal.

Urinalysis showed no gross abnormalities.

Blood Examination: Blood Wassermann was negative. The hemoglobin was 72 per cent; red blood count, 3,850,000; white blood count, 4,350 with 47 per cent polymorphonuclears, 40 per cent lymphocytes, 3 per cent eosinophiles, 0.5 per cent basophiles, and 9.5 per cent monocytes. The red cells showed some achromia.

Skin Tests.—Special emphasis was laid on the tuberculin tests. The material used was human, bovine, and avian tuberculin. The Mantoux reaction was negative. Also the noncommercial tuberculin patch test as described by Grozin[5] was negative. Pus from a completely closed sac located on the face was cultured for tubercle bacilli without result.

Roentgen Examination.—X-ray examinations done by the department of roentgenology of the hospital were as follows: The chest showed lymphomatous masses along the tracheobronchial tract, increased density at the hilus and the roots with moderate secondary root branch and central bronchial thickening. The lesion was entirely central in origin.

The hands revealed areas of osteoporosis in some of the phalanges (Fig 1). The cancellous structures of the bones of both hands appeared somewhat coarsened and radioparent. The feet also showed small areas of rarefaction. X-rays of the long bones were noncontributory.

When the mandible was x-rayed there was seen a circular area of rarefaction situated in about the center of the horizontal portion of the bone (Fig. 2).

Biopsy studies were as follows: The following report is from the Department of Pathology of the New York Post-Graduate Hospital: Tissue examined was taken from epiglottis, larynx, and subglottis, a small piece taken from the trachea near its bifurcation, as well as a nodule situated in the skin of the external ear.

Microscopy: Sections from all the tissue show the same reaction. Beneath the epithelial covering the stroma is made up of closely packed epithelioid cells partly in outlined tubercles, a few of which contained giant cells of the Langhans type. There is no caseation.

Diagnosis: Noncaseating tubercles suggesting sarcoid.



Fig. 1.—Osteoporosis of the phalanges of the hand showing the characteristic absorption frequently seen in affections of sarcoid.

Examination of the skin tissues taken from the tragus of the ear is as follows: The sections have a covering of stratified squamous epithelium. At one point only a few layers of epithelium remain on the surface and this shows exfoliation. The underlying stroma contains numerous hair follicles and is marked by several oval areas of epithelioid cells which replace the connective

tissue stroma. At the margin of these areas there is a small amount of lymphocytic infiltration. No giant cells associated with the tubercles are seen in the sections examined.

The report from the Department of Pathology of the Skin and Cancer Unit of skin tissue taken from another part of the body of this patient revealed: "The epidermis is thin and the basal layer deeply pigmented. Throughout the cutis are many sharply demarcated nodules composed of epithelioid cells and fibroblasts. A few round cells occur as well as multinucleated cells. Marked vacuolization and considerable granular degeneration of the cellular infiltrate are noted."

The above three microscopic reports, one from tissue obtained from the upper respiratory tract, and two from skin, show in the main identical structure.

The marked dissemination of nodules and plaques in various parts of the body would indicate that sarcoidosis is a systemic disease like syphilis or tuberculosis. Furthermore, the rarefaction of the mandible as shown by x-ray definitely establishes the view that this disease may involve the jaw as well as any other structure of the body.

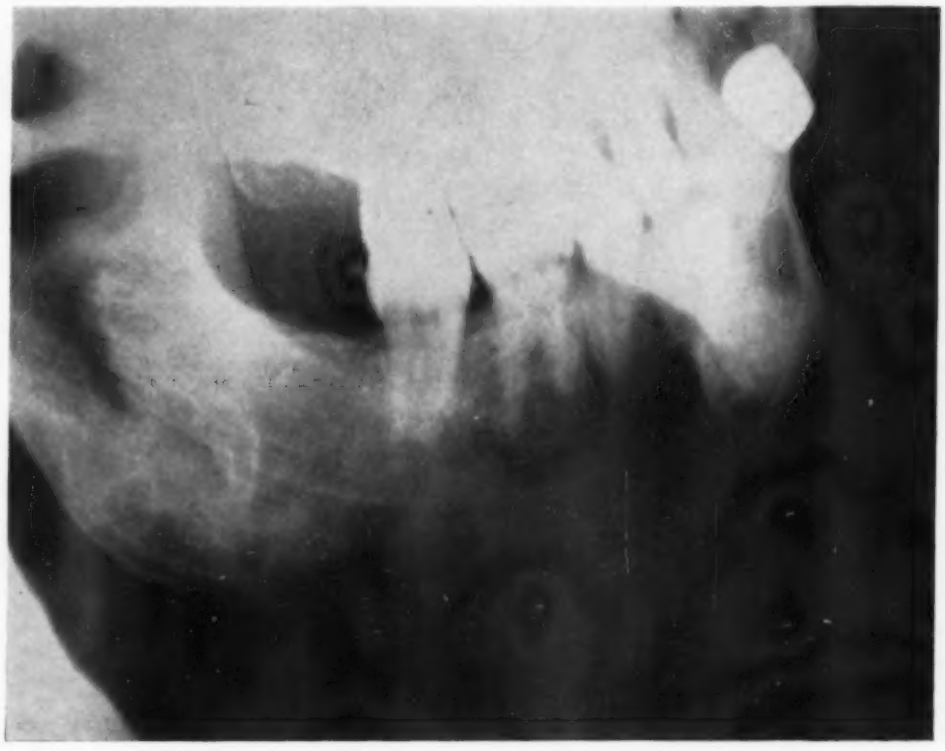


Fig. 2.--Sarcoid resorption of the mandible.

While we do not as yet know the portal of entry of this disease, it might be feasible to regard the respiratory tract,[8] especially the nose, as the first point of attack. This is brought out by the history in this case in which the nosebleeds preceded the cutaneous lesions. Similar observations were made by Novy[6] who obtained a history of attacks of epistaxis prior to the onset of the skin lesions. In the case described by Fletcher[7] there were nasal induration and

hemorrhage before the appearance of sarcoidosis of the skin. It would, therefore, seem that the respiratory tract, especially the nose, bears the initial brunt of the attack after which the disease is disseminated to various parts of the body.

As there is no previous report of a circumscribed osteoporosis of the mandible associated with sarcoidosis, it is difficult to enumerate definitely the various changes taking place in the jaw in sarcoid disease. While the x-ray will show rarefaction of bone, sole dependence should not be placed upon the pictures for a diagnosis. Histologic study must be made of an excised specimen for confirmation.

It is not within the province of this paper to enter into the controversy as to whether sarcoid is a form of tuberculosis. Suffice it to say that all examinations, including tuberculin patch test (Grozin)[5] and Mantoux tests, with highest concentrations of bovine, human, and avian tuberculin, failed to give any evidence of tuberculosis in this case. It also helps to confirm the well-known fact that individuals with this disease are anergic to tuberculin.

The patient was referred to the Otolaryngological Department of the New York Post-Graduate Medical School and Hospital by the New York Skin and Cancer Unit.

SUMMARY AND CONCLUSION

1. A case of sarcoid of the mandible is reported. Diagnosis was made by the presence of sarcoidosis in other parts of the body as proved by biopsy and by x-ray of the jaw which revealed rarefaction of the mandible.

2. It is possible that the portal of entry of sarcoid is the respiratory tract. It is, therefore, suggested that in any case of sarcoidosis the upper respiratory tract be thoroughly examined for areas of induration.

3. Extensive inquiry fails to reveal any previous report of sarcoid of the jaw. Lack of search for this condition is probably responsible for omission of this disease in the medical literature. It is hoped that this report will stimulate search for more cases which will add to our much desired information on the sarcoid of the mandible.

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745 Fifth Avenue

Case Reports

CASE NO. 75

JAW METASTASES IN CHONDROBLASTIC OSTEOGENIC SARCOMA

IRVING H. GOLDSTEIN, D.D.S., AND MARVIN C. GOLDSTEIN, D.D.S.
ATLANTA, GA.

ON NOV. 17, 1938, the patient, S. M., a white male, aged 10 years, was referred by his physician to our office. He complained of occasional discomfort in the lower right jaw, but not any unusual pain. The young fellow seemed to be in good spirits; although he was using crutches at the time and had a low-grade fever.

This patient presented an unusual and interesting history. In May, 1938, he fell and bruised the inner aspect of the lower right tibia. He thereafter experienced slight pain in the same vicinity at various times and was seen by his physician for this complaint.

GENERAL CONDITION

X-rays of the tibia at this time showed an area of bone destruction 3 by 4 cm. involving the lower end of the left tibia. His physician thought consultation was advisable and sent the patient from Atlanta to Johns Hopkins Hospital for additional examination.

In June, 1938, only six weeks after the initial injury it was felt by some physicians in Boston that amputation would be necessary. Others felt that irradiation should be resorted to first, and so this treatment therapy was employed.

The report from Johns Hopkins Hospital in June showed entire skeleton negative for metastases, other than area in tibia, and their diagnosis was chondroblastic osteogenic sarcoma.

Prolonged radiation therapy was given and in September, 1938, report showed that the bone tumor had almost completely been replaced by new bone, and that the growth seemed to be destroyed.

In October the patient returned to Atlanta, at which time x-ray examination showed regeneration of apparently healthy bone, and no extension of primary lesion. Chest and other fields showed no metastases.

LOCAL CONDITION

It was assumed, therefore, that the patient was progressing nicely when jaw discomfort brought him to our office.

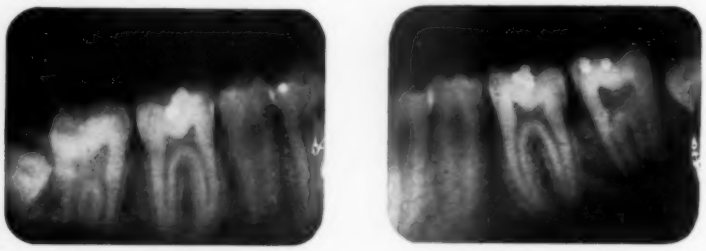
Intraoral examination showed the mouth to be in fairly good condition with no cavities present in the teeth. There was a slight shifting of the bite

to the left side, and in attempting to discover the cause for the shifting, it was noticed that the lower right twelve-year molar was slightly elevated in its socket. On palpation the tooth presented a spongy sensation. Intraoral and lateral jaw x-rays were taken.

Fig. 1 shows full intraoral dental x-rays of left lower (*A*) and right lower (*B*) molar region. Note elevation of right lower second molar.

Fig. 2 shows extraoral film of the right side of the mandible.

The radiograph showed a dark patch approximately one millimeter from the root of the twelve-year molar, oblong in shape. The outline was regular, and additional x-rays showed the same marking. There also seemed to be unusual darkening of the bone about the area of the unerupted third molar.



A. *B.*

Fig. 1.



Fig. 2.

After consultation with his physician it was decided to remove the twelve-year molar. The tooth was uneventfully removed under nitrous oxide anesthesia on Nov. 19. Attached to the root was a mass of soft tissue regular in outline, about equal in size to the area seen in the x-ray. Severe hemorrhage occurred and was controlled by packing. The tooth and mass were sent to the laboratory for biopsy examination. An extraoral x-ray film after the extraction is shown in Fig. 3.

The Laboratory Report

Histologic examination showed the tumor to be composed of rounded, basic staining, bluish cells of a definitely infiltrative type. Most of them were in dense aggregation of rounded clusters, separated by a thin connective tissue stroma. Mitotic figures were present. External to the tumor cells was a dense fibrous, vascular, tissue containing foreign body giant cells.

The pathologist's impression was, "A malignant tumor of a moderate grade of severity involving bony structure of the mandible."

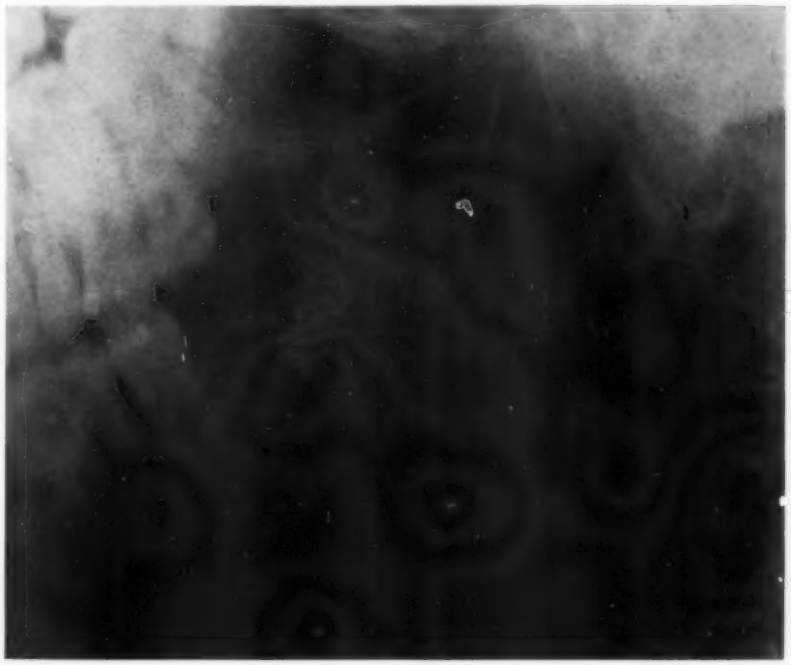


Fig. 3.

CAUSE OF THE DISEASE

The patient was immediately sent back to Boston, where he had undergone previous examination, for further treatment.

The condition, however, progressed, and the patient died at the hospital in May, 1939, approximately one year after the initial leg injury.

Cases of this sort, although fortunately rare, show that the dentist by careful examination and diagnosis is often in position to be the first to see and detect an indication of a general systemic condition.

Grant Building

CASE NO. 76

TUMOR OF MAXILLA

EDWARD C. ARMBRECHT, D.D.S., F.A.C.D., AND C. W. APPLE, A.B., D.D.S.*
WHEELING, W. VA.

THIS case concerns a large slow-growing intraoral tumor in a 62-year-old, slender, white, married American woman.

Chief Complaint: Hard lump in the mouth was the chief complaint.

The patient explained that she first noticed this as a very small swelling about 39 years previously when it seemed to be growing around the upper left molar teeth. A few years later a minor facial neuralgia caused her to consult the dentist who extracted several carious teeth and also excised the swollen tissue from this region. The pain in the face was relieved. However, in time she became aware of a recurrence of the swelling. Several years passed without any further annoyance from pain over this side of her face, although at intervals all the remaining teeth, with the exception of the upper central incisors, had been extracted. During these visits her dentist advised the removal of the swollen tissue which had been gradually increasing in size. Finally, after a period of years, the mass of tissue had become hard and very large, so much so that it was impairing her speech and making the mastication of food very difficult. She was admitted to the hospital Oct. 4, 1941, for surgical treatment (Fig. 1).

Findings.—In the upper left molar region of the oral cavity was found a hard tumor mass about the size of a lemon. It was not tender upon palpation nor was it movable. There were no ulcerations on its surface. The upper central incisors were the only remaining teeth. The floor of the mouth was negative for any swelling or discolorations; the tongue was normal in size and consistency. A slight left lip lag was observed apparently due to the huge intraoral tumor; the patient insisted her lip was not numb. There was no adenopathy throughout the neck region except a moderate-sized mass which was felt over the thyroid gland on the right side. The radiographic study revealed a dense circumscribed mass involving the left maxilla, and it seemed to have its greatest growth downward and into the mouth (Fig. 2).

Blood Examination:

Red blood cells	4,980,000 per c.mm.	Coagulation	5 min.
White blood cells	4,100 per c.mm.	Hemoglobin	92 per cent
Polymorphonuclears	72%	Blood calcium	11 mg. per 100 c.c.
Lymphocytes	28%	Blood phosphorus	3 mg. per 100 c.c.
Blood pressure	180/90	Kline test	negative
Pulse	84	Blood type	2
Temperature	99.6° F.	Basal metabolic rate	20 per cent

From the Oral Service, Ohio Valley General Hospital, Wheeling.
Presented before Hospital Staff meeting, March 12, 1942.
*Oral Surgical Internship.

Preoperative Diagnosis was osteoma of maxilla, hyperostosis of maxilla (Fig. 3).

Preoperative Treatment: Oral hygiene was improved; fluids and fruit juices were forced. R. B. Bailey, M.D., was consulted for an opinion on the thyroid findings and reported: "Adenomatous goiter of a moderate size on the right lobe of the thyroid gland. No rapid pulse nor history of any recent loss



Fig. 1.

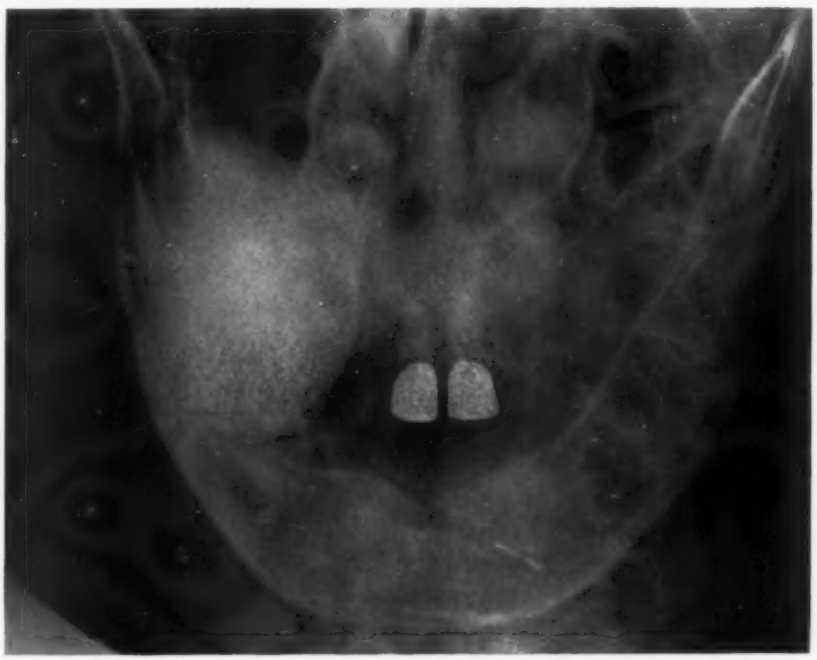


Fig. 2.

of weight. The basal metabolic rate was within normal limits. I do not feel it is a contraindication for the oral surgery planned. Advise its removal at some later time."

Operation: Morphine sulfate, ¼ grain, and atropine sulfate, $\frac{1}{150}$ grain, subcutaneously, were given one hour before going to surgery. Sodium pentothal used as a basal anesthetic while nitrous oxide-oxygen was given by the endotracheal method. After the usual preparation of the mouth field a deep oropharynx gauze packing was placed and the upper central incisors were extracted. An incision was then made from these tooth sockets posteriorly to the tuberosity of the maxilla on the left side. The mucous membrane was dissected away carefully and after a wide exposure was gained, the bony tumor was completely excised with bone forceps and chisels. Profuse hemorrhage was encountered, which required rapid work because this oozing type of bleeding cannot be controlled from any one source. After careful and thorough use of the bone files a plastic repair was done over which a pressure gauze sponge, soaked in a solution of adrenalin chloride, was sutured in place. This not only held the mucous membrane tightly against the bone but also controlled the bleeding, and the patient was taken to her room in good condition notwithstanding the loss of considerable blood.



Fig. 3.

Postoperative Treatment.—An intravenous administration of 1000 c.c. 5 per cent glucose in saline was started immediately, followed with 500 c.c. of whole blood by the indirect method. Dilute Dobell's solution was used frequently as a mouthwash, while the oral cavity was flushed out every three hours with a 2 per cent solution of mercurochrome. Fluids and fruit juices were forced, and except for a moderate amount of swelling the patient made a speedy and uneventful recovery. The pressure dressing, along with the superficial silk sutures, were removed on the fifth day. On the tenth day the remaining sutures were removed, and the patient was discharged from the hospital. She

returned at intervals for observation, and finally after two months she was referred back to her dentist for construction of a denture (Fig. 4).

Blood at time of discharge showed:

Red blood cells	3,900,000 per c.mm.
White blood cells	7,800 per. c.mm.
Polymorphonuclears	74 per cent
Lymphocytes	20 per cent
Hemoglobin	67 per cent

Microscopic study of the tissue which consisted of bone and mucous membrane revealed an increase of interstitial connective tissue throughout spongy cancellated bone. There were a heavy infiltration of large lymphocytes, and no evidence of malignancy.



Fig. 4.

COMMENT

Since 1920, the year when the Bone Registry of the American College of Surgeons was organized, a systematic study has been under way concerning tumors of the jaws. In a general way these tumors have been classified as either odontogenic or osteogenic; the former are derived from embryonic dental tissues whereas the latter from bone cells or bone marrow. However, in the true sense the tumors of the bone marrow are nonosteogenic (for example, the central fibroblastoma). In this case report attention is called to the classification of the true osteogenic tumors, namely:

Benign osteogenic tumors:
- a. Osteoma
- b. Chondroma
- c. Exostosis
- d. Hyperostosis

Malignant osteogenic tumors:
- a. **Osteogenic sarcoma** (all others derived from the stages of osteoblastic development).

Clinically this case fits in such a group, but we found some difficulty in making a final diagnosis until after the microscopic sections were completed because of the clinical similiarity of an osteoma and the local hyperostosis. An effort will be made to compile a comparative list of known facts about each tumor with the hope of arriving at a final diagnosis by the process of elimination.

OSTEOMA	HYPEROSTOSIS
1. Spongiosum (cancellated) Durum (compact) Eburna (stony-like)	1. General (skeleton) Diffuse, spongiosum Local (one bone) Diffuse, spongiosum
2. Occurs in frontal and maxillary sinuses and mandible. (Not very common.)	2. Occurs frequently in the region of the tuberosity of the maxilla
3. Traumatic origin	3. Traumatic or infectious origin
4. Encapsulated and thick cortex	4. Circumscribed and thin cortex
5. No evidence of inflammatory reaction	5. May have evidence of inflammatory (chronic) infiltration of marrow spaces
6. X-ray valuable for differentiation of a dense nonperforating mass	6. X-ray valuable, for differentiation of a diffuse or somewhat dense mass with possible perforation
7. Wide base or pedunculated growth	7. Usually wide base
8. May exfoliate themselves, easily separated from surrounding tissues	8. Profuse bleeding encountered upon their removal
9. Does not recur	9. May recur unless exciting cause is removed or total excision is done
10. Slow growing	10. Slow growing

Final diagnosis was hyperostosis of maxilla.

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77 Twelfth Street

Editorial

Postgraduate Dentistry

The professional man's education is never finished; he must continue to acquire new knowledge throughout his life to keep up to date both in the advances that are constantly made in the art of practice as well as in the application of new scientific facts which are discovered in the laboratories of the various institutions devoted to learning and research. In addition, the field of our profession is constantly widening in scope, and those who do not take advantage of educational opportunities fall hopelessly behind, and, still worse, they may in some respect hinder the advancement of public health.

What are the educational opportunities offered to the profession? They are the meetings held by the various dental societies; they are the journals and monographs, and the postgraduate courses. It is about the postgraduate courses that I should like to say a few words. First of all, "Who should organize postgraduate courses?"

Postgraduate courses are given by some of the dental colleges. Some universities have undergraduate and postgraduate departments in their dental schools. This is a good arrangement because giving postgraduate courses is a different proposition from undergraduate teaching. It is the opinion of many educators that the only duty of the regular teaching staff of a dental school should be to give instruction to undergraduates and those who desire to continue graduate work. Any available free time the teacher has should be devoted to investigation in the clinic, or the laboratory. Refresher courses should be given by the postgraduate department. These are taken by mature men who have been in active practice, and who have, according to their age and school, received a preparatory education of great variance. Although these refresher courses may be concerned with fundamentals as well as with practical work, the subjects must be presented in a manner which facilitates their application to problems occurring in the daily practice of the postgraduate student.

Dental societies in recent years have also paid more and more attention to postgraduate teaching. Refresher courses offered under their auspices have become very popular. The dental society may draw on the resources of the country for lecturers, instructors and clinicians and may offer great variation from year to year in its programs. Generally, however, they lack the physical equipment of a dental school.

The First District Dental Society of New York has overcome this handicap and has just celebrated the opening of a well-equipped suite of operating rooms and laboratories in the Hotel Pennsylvania. According to the announcement, it is offering educational opportunities to "all members of organized dentistry." Practical, clinical and lecture classes are presented in all phases of modern dentistry. We are congratulating the First District Dental Society of New York on the organization of this well-regulated and well-thought-out plan for refresher courses for the practicing dentist.

K. H. T.

Abstracts and Reviews

Atlas of Dental and Oral Pathology: Prepared at the Army Medical Museum, Office of the Surgeon General, United States Army, from material in the Registry of Dental and Oral Pathology by Robert L. Bernier, Major Dental Corps, United States Army, Pathologist to the Registry, and James B. Mann, Colonel Dental Corps, United States Army, and J. E. Ash, Colonel Medical Corps, United States Army, Curator. Second Revised Edition, sponsored by the American Dental Association, Chicago, Illinois, 1942, 178 pages verityped with multilith plates.

This edition as was the first published in 1940 has been sponsored by the American Dental Association. It represents a complete revision of the first edition. A number of new cases have been added together with several pages (12) devoted to dental histology and embryology. The Atlas is primarily devoted to the recording of cases which come under the observation of general practitioners of dentistry, and of oral and maxillofacial surgeons. It is not meant to be a textbook and should be used in conjunction with any one of the standard works on oral pathology and/or oral surgery. In other words, it may be used as a complement to those texts which are purely didactic in nature and fail to cite illustrative cases. It presents the opportunity to study the pathologic findings of actual cases, thus increasing the clinicians' ability to diagnose dental and oral diseases. The Atlas, however, is primarily devoted to the study of morphologic pathology; clinical findings and treatment are only incidentally alluded to. In the Preface the hope is expressed that while the Atlas obviates the technical difficulties of actual microscopic study, it is hoped that the reader will supplement his study of the Atlas by the review of actual pathologic material under the guidance of a pathologist.

The material contained in this volume, in part at least, is from cases contributed to the Registry by a large number of men, and acknowledgment is made in each instance. There are also included cases which have been previously published. Most of the illustrations are photomicrographs, and a few x-rays and clinical pictures are included. Pertinent references have been made to original articles and these if more numerous would aid greatly those who desire to use this Atlas as a basis for a study group and postgraduate study as suggested by the authors. The Atlas has an adequate index.

K. H. T.

Announcement

The Annual Alumni Day meeting of graduates of the College of Dental and Oral Surgery of New York and the School of Dental and Oral Surgery of Columbia University will be held on Friday, Feb. 12, 1943, at the Dental School, 630 W. 168th Street, New York City.



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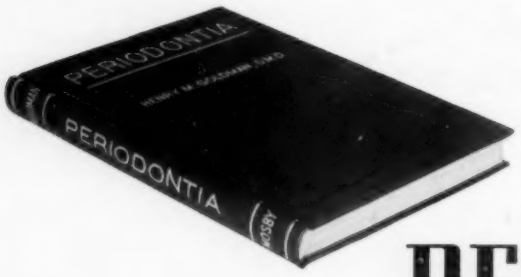
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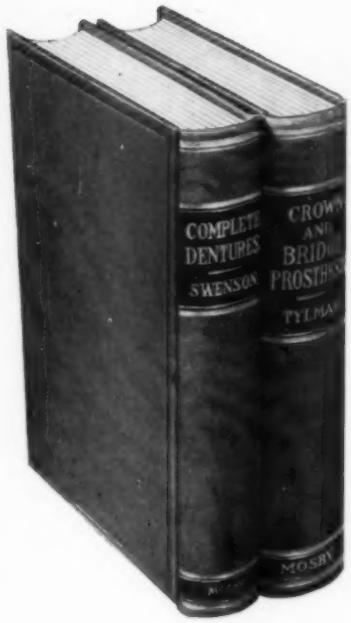
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War Number

The Care of Military and Civilian Injuries

FRACTURES OF THE MANDIBLE, MAXILLA, ZYGOMA, AND OTHER FACIAL BONES

A Statistical Study of 1,149 Cases

Don C. Lyons, D.D.S., M.S., Ph.D., F.A.P.H.A., Jackson, Mich.

MANY problems of diagnosis, pre- and postoperative treatment, surgical technique, and postoperative complications arise during the treatment of any group of fractures involving the facial bones. This is especially true of the bones which are of dental importance. They have prompted the following statistical study in which the conditions found or which have arisen in a series of more than 1,000 cases are recorded.

These fracture cases have been studied from the standpoint of attempting to determine what influential factors may exist which alter the course of the repair of a fracture, or what predetermines the possibility of postoperative complications. Efforts have been made to ascertain whether the etiologic background and type of fracture determines the course of the recovery, or if general constitutional makeup of the individual patient changes the course dictated by the restoration of the fractured bones. The types of fractures and their etiology have been tabulated to determine, if possible, what relationship exists between location, type of fracture, and the procedure necessary to restore the fractured bones to full and normal function. In the case of the mandible and maxilla this must mean complete restoration of the dental arches, occlusion of the teeth, and normal movements of the mandible as physiologically controlled by the muscles of mastication.

It is important to remember that there is a complete physical interrelationship between the bones of the face. For example the maxilla articulates with nine other bones; namely, nasal, zygomatic, buccal, lacrimal, palatine, vomer, inferior turbinate, and the maxilla on the other side of the face. The mandible articulates by a ligamentous joint with the temporal bone. The maxilla helps to form the oral, nasal, and orbital cavities. It is therefore possible that any fracture of the maxilla will involve one or more of these cavities, or other bones. The maxilla is also of particular importance because it helps form the maxillary sinuses, and fractures involving these bones may produce sinus complications. Of important consideration is the fact that because of the interrelationship of the facial bones, all should be thoroughly examined when a fracture is known to exist in either the mandible or the maxilla.

CLASSIFICATION

The old classifications of fractures of the mandible and maxilla do not completely group the types which one sees today, because industrial and auto accidents form the etiology of the greater percentage. Therefore, one usually notes one of the following types of fractures of the mandible, maxilla, or zygoma, namely;

1. Single or multiple
   a. linear fracture, teeth present but apparently not injured.
   b. linear fracture, edentulous mouth.
   c. linear fracture, teeth broken, lost, or devitalized.
2. Compound fracture
   a. linear fracture, teeth present but apparently not injured.
   b. linear fracture, edentulous mouth.
   c. linear fracture, teeth broken, lost, or devitalized.
3. Comminuted fractures
   a. linear fracture, teeth present but apparently not injured.
   b. linear fracture, edentulous mouth.
   c. linear fracture, teeth broken, lost, or devitalized.
4. Pathologic fractures
   a. linear fracture, teeth present but apparently not injured.
   b. linear fracture, edentulous mouth.
   c. linear fracture, teeth broken, lost, or devitalized.
5. Persistent or ununiting fractures
   a. linear fracture, teeth present but apparently not injured.
   b. linear fracture, edentulous mouth.
   c. linear fracture, teeth broken, lost, or devitalized.
6. Various combinations of the above or involving either condyle or coronoid process
   a. linear fracture, teeth present but apparently not injured.
   b. linear fracture, edentulous mouth.
   c. linear fracture, teeth broken, lost or devitalized.

Breakage and loss of teeth complicate the procedures necessary in the reduction of the fracture and increase the possibility of an incidence of infection. Any method of rehabilitation of the case must include complete restoration of the broken or lost teeth.

ETIOLOGIC FACTORS

Tables or charts have been prepared to correlate the findings which are represented in these cases and to emphasize the significant data which they present.

In this group of cases the auto accident played the greatest part, although the industrial accident was a close second, Chart 1. Fractures of the mandible, maxilla, or zygoma were caused by auto accidents in 586 cases. Industrial accidents accounted for 367 cases, of which 108 were railroad employee accidents; 221 took place in machine shops or similar types of factories, 28 in other factories. Ninety-one fractures were caused by fighting or by thrown objects, and 105 were caused by various other factors. In the industrial group the most common causes were as follows: metal bar slipped, tools slipped,

machinery came apart or failed, machine or tool broke, flying metal, wood, stone, etc., wood or metal part of machinery dropped from a height by a fellow employee, patient fell from crane or slipped from a loading platform, was thrown from trailer or truck during loading or unloading operations.

In the miscellaneous group causes were: slippery sidewalks or pavement, falls on streets, falls from scooters or bicycles, from motorcycles or motor driven vehicles (not automobiles), and from horses; accidents caused by various recreations, such as children's baseball, skating, sleighing, skiing, and on playgrounds. With adults it was baseball, golf, skiing and miscellaneous falls, airplane accidents, kicks by animals, and hunting accidents. This group also includes falls in home by children, falling out of beds, children falling down stairs, adults falling down stairs, children and adults falling in bathtubs, falls associated with apoplexy or illness, stumbling over toys, etc.

Study of Chart 1 reveals the fact that 48 per cent of the total fractures fall in type 1, 29 per cent in type 2, 13 per cent in type 3, 0.05 per cent in type 4, 0.05 per cent in type 5, and 9 per cent in type 6. In other words, the majority of the fractures in a large group are simple fractures regardless of cause of the accident. It is also interesting to note that 60.4 per cent of the total fractures studied had involved teeth, either broken, knocked out at the time of the accident, loosened, or subsequently found to be devitalized.

CHART 1

SUMMARY OF 1,149 CASES OF FRACTURES OF THE MANDIBLE, MAXILLA, AND ADJACENT FACIAL BONES

	NO. OF CASES	TYPE 1			TYPE 2			TYPE 3			TYPE 4			TYPE 5			TYPE 6		
Cause of Fractures		a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c
Auto Accidents	586	135	16	79	44	10	157	12	8	62	–	–	–	3	–	2	4	8	46
Industrial	367	54	5	137	13	25	38	24	2	32	–	–	–	–	–	5	18	2	12
Fighting	91	21	4	31	8	2	19	–	1	3	–	–	–	–	–	–	1	–	1
Miscellaneous	105	18	1	45	2	1	13	5	–	1	3	–	8	1	4	–	–	–	3
Total	1149	228	26	292	67	38	227	41	11	98	3	–	8	4	4	7	23	10	62

INJURY AND LOSS OF TEETH

One of the greatest hazards in fractures of the jaw is the loss of teeth. In a group of 300 cases, selected because it was mentioned on the history that teeth had been lost, 955 teeth were lost or approximately 3 teeth per case, the smallest number being one tooth lost and the greatest being 9; 180 of the fractures were sustained in auto accidents, and 120 in various other ways (Chart 2). It is not, however, noted on these histories whether or not teeth were lost at the time of the accident or subsequent to the production of the fracture.

In this group of fractures the maxilla was involved in 204 cases and the mandible in 112. In sixteen cases both jaws were involved. These figures are to be expected, for maxillary fractures are more conducive to tooth injuries than other fractures. From a standpoint of location, it is interesting to note that posterior to the cuspid teeth fractures occur equally right and left. Auto accidents account for 60 per cent of the dental injuries, industrial and miscellaneous about the same percentage.

In those cases where the author had opportunity to follow the case for some time after the reduction of the fracture, where there were broken teeth,

several factors were noted. Even though these teeth, at the time of the reduction, did not need to be extracted because the break did not seem deep enough to warrant their removal, a large per cent subsequently became devitalized and abscessed, requiring their removal. This is an additional hazard which requires follow-up treatment over a period of time. In every case where there are broken teeth or the fractures are adjacent to the roots of teeth, the patient should be instructed to have postoperative checkups at frequent intervals for a period of at least one year, because many of these broken teeth have pulpal tissues which degenerate very slowly. This factor must be considered in compensation and insurance cases.

CHART 2

FRACTURES INVOLVING LOSS OF TEETH

TYPE	NO. OF CASES	LOCATION					CAUSE			JAW INV.		NO. TEETH LOST
		M	CM		PM		AUTO	IND.	MISC.	MAX.	MAND.	
			L	R	L	R						
1	96	54	30	12	–	–	54	18	24	60	36	172
2	48	–	18	24	6	–	24	–	24	43	5	156
3	120	12	30	44	–	12	85	29	6	73	47	525
4	5	–	–	–	–	5	–	–	5	5	–	23
5	7	–	7	–	–	–	–	1	6	5	–	5
6	24	12	12	18	6	18	17	7	–	18	24	74
Total	300	78	97	98	12	35	180	55	65	204	112	955

M., Median section of jaws.
CM., Cuspid to third molar region, left or right.
PM., Posterior to molars, left or right.

Restoration of broken teeth must, of course, follow the reduction of the fractured jaws. Exposed surfaces which may produce pain should be treated as soon as possible before the fractures are reduced. Copper, stainless steel, precious metal bands, or celluloid caps should be cemented upon these teeth and filled with sedative cement. In some instances a precipitated coating of silver upon a broken tooth surface will densensitize the surface and prevent decay or pain until more adequate treatment can be given. It is not the proper procedure to allow these surfaces to remain exposed without any treatment for a long period of time, particularly during the time the braces are in place, for they may cause pain which is difficult to treat at that time. Any rough surface or broken tooth surface makes just one additional area where food debris can accumulate during the treatment of the fracture, and this may be the one factor which induces the development of postoperative infection. One should expect that a certain percentage of the broken teeth will subsequently become devital and infected. In this group of 300 cases in which there is history of broken teeth, one or more per mouth, it was noted that 141 of these cases either immediately or later complained of devital teeth which had to be treated with root canal fillings or had to be removed (Chart 3).

It will be noted that color change and looseness were the greatest factors in discovery of subsequent devitalization of teeth. Pain as a factor diminishes as time following the operation increases, for the chronically infected tooth or devital tooth is seldom painful. Only 20 per cent of the teeth proving to be subsequently devital were identified by pain as compared to 30 per cent by color change or looseness.

Many of these teeth did not show any signs of degeneration of nerves for months following the date of accident, but x-ray checkups later demonstrated an area of infection at the root apex. Others become loose and do not retighten, demonstrating the fact that the periodontal membrane had been completely or partially destroyed around the roots of these teeth. A third group of devital teeth disclosed their presence only by their change in color or discoloration which is typical of the dead tooth. The fact that several or more teeth in a recently fractured jaw do not respond to vitality tests is not always an indication that these teeth are nonviable and therefore should be removed. In the first place the surgeon must rule out the possibility of injury to the mandibular or maxillary nerves and loss of sensation due to that entity. If this has been checked and the teeth are still questionable, it still may not be necessary to remove such teeth unless there is obvious evidence of infection, because in many cases nonviable pulps will gradually calcify as long as they remain noninfected. Such teeth may remain in the mouth as useful teeth for years. Many of these questionable teeth may show absolutely no evidence from an x-ray standpoint of a pulp canal; they are not vital from the standpoint of electric, mechanical, or ice tests; yet from a bacteriologic standpoint they are negative, and they are useful members of the dental economy.

CHART 3

SUBSEQUENT DEVITALIZATION OF TEETH NOTED

TYPE OF CASE*	PAIN NO. TEETH AFFECTED	DISCLOSED BY X-RAY	COLOR CHANGES	LOOSENESS
Auto Accident	16	38	51	66
Industrial	47	29	3	14
Fighting	2	8	13	5
Miscellaneous	1	17	26	9
Total No. of Teeth Involved	66	82	93	94

*Total number of cases 141 out of 300.

LOCATION OF FRACTURE

A statistical examination of this series of fractured jaws on the basis of type of fracture, location, cause of fracture, and the jaws involved, as shown in Chart No. 4, indicates a number of factors. The most common type of fracture is the type 1 or linear fracture; of these, 410 fractures were sustained in the mandible and 136 in the maxillary bone. The most common location for this type of fracture is in the region from the cuspid tooth to the last molar tooth. One hundred fifty-six were found in the right jaw and 128 in the left mandible or maxilla; in 77 cases both right and left were involved. Eighty-six of these fractures were to be found in the midline somewhere between the left and the right cuspid. While no effort was made to chart the exact location of this particular fracture, it is believed that most of them lie just medial to the cuspid teeth. Sixty-three linear fractures were diagnosed posterior to the third molars on the left side and 36 on the right side.

The compound fracture was next most common, and in this series 332 were treated. The most common location for the compound fracture appears to be on the right side, 102 cases being treated; 183 cases involve the mandible, and 149 the maxilla.

CHART 4

LOCATION AND CAUSE OF FRACTURES

KIND OF FRACTURE	LOCATION								JAW INV.		CAUSE				
TYPE	M	ML	MR	RML	PML	PMR	RC	LC	MAND.	MAX.	AUTO	IND.	FIGHT	MISC.	TOTAL
1	86	128	156	77	63	36	–	–	410	136	230	196	56	64	546
2	80	30	102	58	34	28	–	–	183	149	211	76	29	16	332
3	36	16	56	19	13	10	–	–	42	108	82	58	4	6	150
4	0	2	4	0	3	2	–	–	11	0	0	0	0	11	11
5	0	1	9	0	1	4	–	–	15	0	5	5	0	5	15
6	1	15	21	18	5	4	68	49	64	31	58	32	2	3	95
Total	203	192	348	172	119	84	68	49	725	424	586	367	91	105	1149

Explanation: *M*, Median section of jaws. *ML*, Median to left third molar. *MR*, Median to right third molar. *RML*, Fractures, both right and left side. *PML*, Posterior to molars, left side. *PMR*, Posterior to molars, right side. *RC*, Right condyle or coronoid involved. *LC*, Left condyle or coronoid involved.

It was noted that the right side also seems to be the most common location for compound comminuted fractures, 56 being found in this series to involve the right maxilla or mandible, and it is noted that 42 cases involve the mandible, but 108 involve the maxilla. This is to be expected because most of these accidents involve the guest passenger in the right front seat of a car, the vulnerable side of the individual being the right side of the body or face in such cases. The number of pathologic fractures or persistent fractures is not of particular interest, nor are the factors involving the mixed type of fracture. However, in this instance it is noted that in a certain percentage of the cases, both condyles or coronoid processes are involved, for the total number of these is 22 more than the total number of fractures. In approximately 20 per cent of the fractures involving the condyle or coronoid process, both sides of the jaw are injured.

The totals also bear out the fact that the right side of the face is more vulnerable to fractures than the left. Five hundred eighty-six of the total fractures involve the right side of the face as against 446 involving the left side of the face. The mandible appears to be more vulnerable than the maxilla, 725 involving the mandible and 424 involving the maxilla. In many cases involving the maxilla, fractures involve associated bones such as the nasal, zygomatic, palatine, and etc.

COMPLICATIONS

It is very important that the oral surgeon recognize the possibility of other complications in the treatment of fractures of the mandible and maxilla. Skull fracture is common with cases of this sort, shock due to loss of blood is also a frequent complication and should be treated as quickly as possible. Complications due to injury to other cranial nerves, especially to the seventh and to the fifth nerve, may produce areas of paralysis and of anesthesia which should be diagnosed preoperatively if possible. It is the belief of the author that practically all postoperative complications arise because of failure to diagnose completely and prepare for all existing preoperative conditions. This is especially true of cases of osteomyelitis which develop in fractures of the mandible.

CASE REPORT

The following case is typical of the value of complete study of the case before operative procedures are instituted. Mrs. R. K., aged 27, was brought

to the hospital following an auto accident. When first examined the patient was unconscious, in a state of shock, and bleeding from both ears. There were extensive cuts and bruises of the lips, face, chin, and neck, with the lower lip torn completely open, exposing the mandibular teeth. Extensive swelling and infection quickly developed in the mandible, spreading into the neck, making it difficult for the patient to breathe. Although there was obvious evidence of fractures of the jaws, adequate x-rays could not be taken until the other symptoms of skull fracture, the infection, and shock were treated to a point where the patient could be safely moved and the proper positional x-rays taken to determine the full extent of the injuries. After an interval of ten days, during which medical supportive treatment was instituted, the shock alleviated by transfusion, and infection controlled by sulfanilamide, the proper x-rays could be taken. The following is copied verbatim from the hospital report: "Frontal and lateral stereoscopic studies of the mandible revealed a transverse fracture of the left mandibular condyle just above the junction with the coronoid process. There is a fracture of the right ramus beginning just above the coronoid process and extending downward to the angle. There is overriding of about one-fourth inch on the left and about the same on the right. There is an oblique fracture of the mandible beginning at the point of the chin and extending completely upward ending between the right lateral incisor and the left canine. A small triangular fragment is separated from the lower portion of the fracture line. The upper central teeth are apparently moved anteriorly with a fracture into both maxillary alveolar processes. Fracture at the base of the skull. Both mastoids are apparently clear."

Objective examination of the mouth showed that the maxillary right lateral, central, left central, and right lateral teeth were forced upward into the maxillary bones, splitting them anteroposteriorly. The right first molar, first bicuspid and cuspid, and the mandibular first bicuspid were broken. The mandibular right cuspid, right lateral, right central, left central and left lateral teeth were loose. There were extensive ragged-edged cuts and bruises in both lips, with the lower lip separated at the midline for a depth of about one inch. The gum tissue of both jaws in the anterior part of the mouth was torn from the bone attachment, and cuts extended into the floor of the mouth at the base of the tongue. After a period of ten days the acuteness of the infection of the mandible subsided sufficiently to permit more diagnostic x-rays, but pus was still draining from several fistulas under the chin at this time. Fifteen days after the accident the patient was given a general anesthesia, and the multiple fractures of the jaw were brought into apposition and reduced. The maxillary central and lateral teeth were removed because of their impaction into the maxilla. A number of fragments of bone were removed from this area. The fracture braces were wired into place, elastic traction was applied as interdental ligation, the infected area in the mandible was probed, and a drain was inserted. At the end of eight weeks it was possible to ascertain the condition of the remaining teeth. X-rays taken then showed the following: the maxillary right first bicuspid was broken with a possible exposure (this tooth subsequently died and had to be removed), the buccal surface of the cuspid tooth was broken, the mandibular right lateral was loose and infected, the mandibular left lateral was loose and infected, the medial surface of the max-

illary right first bicuspid was broken, the mandibular right cuspid tooth in line of fracture showed possible infection, and the mandibular right central and left central were loose and infected. The infected teeth were removed at this time. The extensive damage done to the teeth will naturally lessen their life expectancy, and damage done to the gum tissue predisposes to gum disease (in the future). The osteomyelitis of the mandible subsided four months after the accident, but a number of bad scars remain under the chin, requiring plastic surgery at a later date. Extensive torn tissue of the lower lip has also left a bad scar which will require plastic surgery at a later date. It is impossible to predict a prognosis of the damage to the ligaments of the articulation of the jaws, due to the blow which caused extensive fractures of both condyles of the rami of the mandible. Articulation of the teeth, however, has been completely restored, and when the damaged teeth have been repaired, function will be regained.

This case is typical of the extensive damage which can be done by an auto accident and demonstrates the necessity of careful diagnosis previous to operations for reduction of fractures.

The necessity of adequate records of all broken teeth and future life expectancy is clearly demonstrated in this case, which became a court case suing for recovery, for damages to health, etc. All of this type of case must be considered and expectant prognosis carefully charted, because a great percentage involve insurance, compensation, or court proceedings.

TREATMENT OF COMPLICATED FRACTURES

The complication observed in many cases, treated in outlying districts where the services of an oral surgeon are not available, is that of unnecessary loss of bone. One of the first principles in the reduction of any type of fracture of the facial bones is conservation of tissue and of bone. Because of the rich blood supply to these tissues, conditions which may appear rather hopeless at the time of first examination, due to extensive tearing of tissue and comminution of bone, if treated conservatively, often result in very favorable results. This is demonstrated in a recent article by Kazanjian* in which he shows that fractures treated by immediate suturing and reduction in field hospitals during the last war, did not produce as favorable an end result as first-aid methods, until the patient could be admitted to a base hospital at a later date.

In most instances the advisable procedure is to delay removal of bone fragments and débridement of tissue until these tissues are obviously without blood supply or are becoming necrotic and warrant removal.

CASE REPORTS

The following two cases are typical of results of unnecessary removal of bone and tissue. In case of Mrs. S. W., the patient sustained a fracture of the left maxilla as a result of an auto accident. This occurred in a small midwestern community, and the physician in attendance removed the entire maxilla because it was loose; the antrum was exposed and the tissues were then

*Kazanjian, V. H.: An Outline of the Treatment of Extensive Comminuted Fractures of the Mandible, AM. J. ORTHODONTICS AND ORAL SURG. 28: 265 (Oral Surg. Sect.), 1942.

sutured into position. These sutures soon sloughed out and the result was a deformity which could only be restored by the use of an extensive partial denture and prosthesis.

Case of Mr. B. D. is similar in many respects, except that this individual sustained a fracture of the mandible, at which time a segment carrying all of the anterior teeth from cuspid to cuspid was broken loose. Again the attending physician removed this fragment, with complete destruction of the anterior portion of the mandible. After extensive prosthesis the individual has had the condition restored to some extent, but there is still a noticeable defect in the musculature and the shape of the lower lip.

UNUNITED FRACTURES

In this series fifteen cases of persistent or ununited fractures are listed. The cause of these fractures is of particular interest. They are as follows: persistent or ununited fracture due to loss of bone substance resulting in lack of contact between the fragments, six cases; due to presence of debilitating disease, two cases; due to old age, one case; presence of cysts or other abnormalities, two cases; failure to diagnose presence of fracture and reduce same, four cases.

The last four mentioned cases deserve special mention, for these four cases could easily have been subject to malpractice suits except for very judicious handling. This is especially true because all four cases were presumed to have received adequate attention by those first examining them.

In the first case the patient, P. R., gave a history of an auto accident, causing injury to the jaw. He was admitted to the receiving ward of the hospital, given first aid, and dismissed without further examination or x-rays. Pain persisted in the lower left side of the mandible, and after a period of three months in which the patient complained of pain continually, he was referred for further examination. This time x-rays were taken, showing a fracture extending from between the left mandibular cuspid and first bicuspid, diagonally forward to the lower border of the mandible under the left lateral incisor. There were displacement of the fragments and an impaction of fibrous tissue between the separated fragments. Upon removal of this tissue, scarification of the ends of the fractured bone, and the proper reduction, the patient made an uneventful recovery and the pain disappeared.

The second case, J. H., was a man who had been injured while working as a section hand on a railroad. A passing train dislodged a metal bar which was thrown against his face. He was given first-aid treatment and was dismissed. Several days later he complained of pain in the mandible and was sent to a dentist who, apparently noticing a chipped lateral incisor, decided that the entire pain was due to that, and treated the tooth. This patient's teeth being rather crooked, it may be said that it was perhaps somewhat difficult to determine the slight displacement of the bone fragments in this particular instance. However, the pain persisted, and examination by a physician two weeks later still did not disclose the real cause of the pain; sedatives were given to the patient, which only temporarily relieved the persistent pain. Two months after the accident the patient was referred for further examination,

at which time x-rays were taken, confirming the apparent diagnosis of crepitus in the region of the mandibular right lateral and cuspid teeth. This disclosed a fracture, extending from between these two teeth to the lower border of the mandible. The edges of the fragments were freshened, and a retaining brace placed on the mandible. Upon removal of this, six weeks later, the fracture appeared united and the pain relieved.

The third case is that of Mrs. L. B., who sustained a fracture of the maxilla which was not diagnosed at the time of the accident. Persistent pain in the region of the maxillary left first, second, and third molars, and the feeling of movement when the jaws were closed, led this patient to seek further treatment, but adequate diagnosis was not made until three months later, when the patient, still complaining of persistent pain, was referred for further examination. This time it was discovered that there was a fracture in the buccal wall of the sinus extending toward the midline of the palatal bone and back to the attachment of the zygomatic bone. There was a slight displacement to the buccal of the three molars in question. Upon adequate treatment and reduction of the fracture, the pain subsided and the case was dismissed.

In the fourth case, the patient, Mr. J. L., a man 75 years of age, with edentulous jaws, gave a history of having a slight stroke and falling down the stairs of his home. At the time he was treated for a general condition, and no attention was paid to the fact that his denture had been broken, or that there was a possibility of a fracture of the jaw. Examination four months later, when the patient appeared for reconstruction of the lower denture, disclosed a fracture of both the right and the left side of the mandible, overriding of the fragments, and movement of the anterior portion of the mandible. By open reduction the ends of the fragments were freshened and then brought into place by the use of stainless steel screws and wires. After a period of eight weeks these were removed; the fracture appeared united, and a correct prosthesis was supplied.

SUMMARY

Examination of this series of cases indicates that one of the greatest hazards or complications associated with fractures of the jaws is loss of teeth or fracture of the teeth themselves. Restoration of these teeth is an important part in the reduction of the fracture and the restoration of normal dental function.

It is important to recognize the existence of all other complications especially the possibility of fractures of the skull. A suitable delay is of value to determine the existence of these complications and allow for control of hematomas, cellulitis, treatment of infection, etc. Every effort should be made to save tissue and bone fragments. In this respect the operation should be as conservative as possible.

Standardization of methods of reduction should be attempted wherever permissible, and every effort should be made to have the patient ambulant as soon as possible. Many of the present methods of reduction of fracture make it possible for the patient to return to work quickly and to keep the mouth clean, reducing infection, and maintain a fairly normal diet.

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THE USE OF REMOTE FLAPS IN REPAIRING DEFECTS OF THE FACE AND MOUTH

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REPAIR of full thickness defects of the cheek, nose, or palate can be carried out only by the use of flaps composed of skin and subcutaneous fat attached to the body by a pedicle which transmits the vascular supply. When the defects are large, remote flaps are utilized in order to secure adequate amounts of skin for both lining and surface covering. Only with sufficient tissue can satisfactory functional and cosmetic results be secured. Preferences in the type of flap chosen for different repairs have been indicated in the surgical literature by numerous authors. The purpose of this paper is to describe three methods and indicate why each was selected in performing the reconstruction.

Several points must be considered in the choice of a flap. First is whether sufficient tissue for the repair can be obtained from the donor site chosen. For example, a larger flap can be secured from the neck or abdomen than from the forehead. Second is the comparison in color and texture of the skin of the flap with the skin of the face. Thus, a flap from the forehead will more nearly match, than one from the arm or abdomen. Third is the presence of hair on the flap which can mar an otherwise completely satisfactory result. Hair on an exposed surface can be kept trimmed but inside the mouth it is annoying and interferes with proper mouth hygiene. And fourth are the proximity of the flap and the number of operations necessary for its transfer. For example, an abdominal flap cannot be shifted directly to the face but must have an intermediate attachment either to the forearm or at the base of the neck. A flap from the forehead or upper arm can be transferred directly.

The preparation of a large flap must usually be carried out in stages. During the preparation all blood vessels except those entering through the pedicle are severed. These latter vessels are thus stimulated to develop and will nourish the full length of the flap at the time of transfer. The delayed flap and the tubed flap are the most commonly used.

The delayed flap is prepared by partial or complete undermining of the skin, leaving the pedicle and the distal attachment unsevered. The flap is then replaced in its bed and the skin margins are sutured. The undermining is completed and the distal attachment severed ten to fourteen days later. The tubed flap is also prepared by partial or complete undermining of the skin. It is not replaced in its bed but the skin edges are sutured together to form a tube and the bed is either closed beneath it or covered by a free graft. Occasionally these flaps are lined by a free graft on their deep surface when it is desirable to restore the covering and lining of a defect at the same time. This flap is known as a lined flap.

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The planning of multistage repairs utilizing flaps is of the utmost importance. Careful measurement and patterns of the defect are made to determine the size and shape of the flap and to determine whether sufficient tissue is available from the donor site chosen. The pedicle is planned so that a good blood supply will be insured and so that the end of the flap will reach the defect without tension. Undue tension interferes with proper circulation and may cause necrosis of the distal end. It is wise before severing the pedicle to test the collateral circulation to the flap by temporary application of a tourniquet. If the color of the flap remains good, the pedicle can be safely cut. Attention to these details is important not only for success in the repair but also for its completion in a minimum time. A casually planned procedure seldom is a total success.

The forehead flap is most useful in replacing tissue loss of the nose but can be used for repairs of the cheek or lips. When used for the nose the flap is carried on a small pedicle with the supraorbital vessels, but when used for repairs of the lip or cheek a long wide pedicle from the temple containing the temporal vessels is necessary in order to reach the defect. The first repair to be described is of the cheek. The forehead flap was chosen in this case because it is the most readily available and can be transferred with the minimum of discomfort and disability. The absence of hair is advantageous since part of the flap was used for cheek lining. In spite of the patient's narrow forehead sufficient skin was present for the repair. The difference in color and texture were of secondary importance (Fig. 1).

Case 1 (C. P. H., 41,221).—A man, 64 years of age, had an indurated tumor of the left cheek, 3½ cm. in diameter, involving both the skin and mucous membrane. This tumor proved to be squamous-cell carcinoma, grade 1. Since x-ray treatment for the lesion had been given but failed to control the growth, it was felt that the only chance of cure lay in wide local excision. This operation was done in March, 1941. The preparation of the forehead flap was started at the same time. An incision across the hairline of the forehead was extended laterally to the posterior border of the left ear. A second incision just above the eyebrows was carried downward over the left zygoma. The skin flap was undermined completely by dissecting between the galea and the pericranium. After an interval of two weeks the flap was completed by cutting across its distal end.

Since no recurrence was evident at the end of three months the repair was started. The flap was raised from its bed and, after incising through the healed margin of the defect in the cheek, the distal end and sides of the flap were sutured to the mucosal borders. With the proximal portion of the flap thus folded back on the distal portion, the skin edges were sutured above and below to the cheek. Three weeks later the flap was opened at the fold and adjusted to the borders of the lips forming a new corner of the mouth. At the same time the raw surface on the forehead was grafted. In two weeks the pedicle was severed and returned to the temple. The cut edge of the flap was fitted to the adjacent cheek.

A minor adjustment of the margins of the flap was done nine months later and the final operation, a fascial transplant, in October, 1942. Because

of the absence of muscle pull on the left side of the face there was a droop of the corner of the mouth and a general deviation of the mouth to the right, both of which became more apparent as the edema left the flap. Three loops of fascia lata engaging the upper lip, the corner of the mouth, and the lower lip were inserted through a small incision in the temple and anchored to the temporal muscle and fascia. These loops fixed the mouth and reduced the asymmetry.

This patient exemplifies the importance of planning in multistage procedures. The major functional repair was completed five months after the excision of the cheek. Subsequent procedures during the following year were done more for cosmetic than functional reasons.

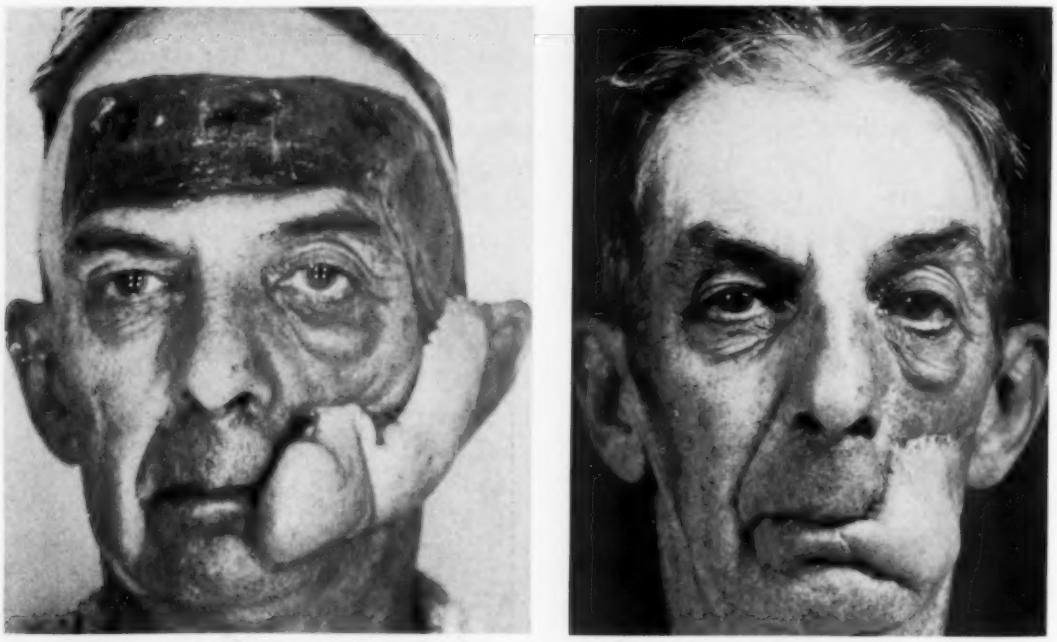


A. *B.*

Fig. 1.—Illustrating the use of a forehead flap in the repair of a large defect of the cheek, the result of extensive excision for carcinoma. *A*, Appearance of the cheek before excision. *B*, After excision, showing the defect and the outline of the forehead flap.

A flap from the inner surface of the upper arm is generally useful for repairs about the face. More skin is available than can be secured from the forehead. There is a delicate texture to the skin, but it may be whiter than that of the face and occasionally there may be a fine growth of hair. The transfer is usually carried out with the arm held flexed across the top of the head. Only in this way can the pedicle reach from the arm to the face. One of the advantages of this flap is that scarring on the inner side of the arm is inconspicuous. The second repair to be described is of a gross palatal defect. An arm flap was chosen because of accessibility to the posterior half of the mouth. It was tubed to insure greater cleanliness and to diminish the risk of infection. A full thickness graft was used to cover its upper distal surface, which will form the floor of the nose. The full thickness graft is preferred because it shrinks less than a thinner graft (Fig. 2).

CASE 2 (C. H., 18,810).—A girl, 21 years of age, had had a repair of a cleft palate about a year before. There were no palatal processes and only enough tissue was present to close the posterior palate. The normal motions of the palate during speech were present but a large anterior defect remained.



C. *D.*

Fig 1.—*C*, After the flap has healed to the posterior margins of the defect but before opening and attaching the folded edge to the upper and lower lips and before grafting the forehead. *D*, The flap in place, showing the sagging of the cheek and the displacement of the mouth to the right.



E. *F.*

Fig. 1.—*E* and *F*, After the fascial transplant, showing the correction of asymmetry and the incision in the temple for insertion of the fascial strips.

Since the alveolar arch was intact and since the patient had tried a prosthesis and preferred not to wear it, the decision to close the defect with extraoral tissue was made. The flap was prepared in August, 1942. Parallel incisions, 5 cm. apart, were made on the medial surface of the left upper arm from axilla to elbow. The skin was undermined and a tube formed. At the distal end of the tube the undermining was extended and a full thickness graft about 5 cm. in diameter was used to line the space. The raw surface of the bed was covered by a split thickness graft. The second stage was done one month later.



Fig. 2.—Illustrating the use of a tubed-lined arm flap in the repair of a large congenital palatal defect. *A*, The palatal defect, showing the posterior closure and the absent palatal processes.



Fig. 2.—*B*, The tubed arm flap before transfer, showing the approximate outline of the full thickness graft used to line the end of the flap.

The distal end of the flap was transected and sutured to the freshened, freely bleeding, anterior border of the residual palatal tissue. A broad surface of contact was secured. The left arm was held in a plaster cast and a wedge

between the molar teeth protected the pedicle from being bitten off. The third stage was carried out three weeks later. The pedicle was cut across and since only a thin layer of membrane covered the lingual surface of the alveolus, because of the earlier palate repair, no suturing of skin to mucous membrane



Fig. 2.—*C*, The flap in place within the mouth, showing the pedicle and the immobilizing cast.



Fig. 2.—*D*, The completed repair, showing the fullness of the flap which will be reduced.

could be done. Therefore the membrane was stripped off the bone and the flap was held loosely against the alveolus by wire sutures that engaged several teeth about the arch. Healing was complete except for a small perforation in the midline posteriorly.

This patient has noticed improvement in speech, greater comfort in eating, and much less mucoid discharge into the nasopharynx as a result of the operation. She may need to have the thickness of the flap reduced to wear a small upper denture. This operation is described by Veau as a "surgical monstrosity." The objection is valid when there is an alveolar cleft, retraction of the upper lip, and underdevelopment of the bony arch. In such cases restoration of normal facial contours and closure of the palatal defect can be accomplished with a single prosthesis. However in the case described above there was a large palatal defect without deficiencies of the alveolar arch and upper lip. A prosthesis was therefore not indicated.

The forehead flap is preferable in total reconstruction of the nose but occasionally the forehead is not the necessary seven centimeters wide. The inner surface of the upper arm may be used as in the third repair to be described. In preparing the flap incisions on the arm were made seven centimeters apart but tubing of the flap was not done because little danger of infection exists with extraoral use (Fig. 3).



Fig. 3.—Illustrating the use of an arm flap in total reconstruction of the nose. *A*, Appearance of the lesion of lupus vulgaris at the time of amputation.

Case 3 (M. G. H., 62,544).—A woman, 32 years of age, had lupus vulgaris of the tip of the nose. The lesion continued to enlarge in spite of local and general measures including sanitarium care. Therefore a radical diathermy excision of the nose was done in January, 1941. The repair was started seven months later with the preparation of a delayed arm flap. Parallel incision, seven centimeters apart, were made from the axilla to the elbow of the left arm and the intervening skin undermined. One week later healing was complete and the distal end was cut across with a curved incision. Another three months was allowed to elapse without recurrent infection before the arm flap was transferred to the nose. A curved incision was made over the dorsum of the nose and the skin of the dorsum turned downward to form the lining of the nose. The flap was attached to the raw surfaces by suturing its borders to the margin of the incision. The pedicle was loosely tubed and the arm immobilized

with a plaster cast similar to that used in Case 2. Eighteen days later the pedicle was severed and the defect remaining in the upper arm grafted. After another four months the tip of the nose was shaped by folding the excess skin inward to form the two alae and the columella. As the edema of the new nose subsided a depression above the tip due to inadequate support became



B.



C.

Fig. 3.—*B* and *C*, After amputation.



Fig. 3.—*D*, Profile after transferring the flap and shaping the nose, showing the dorsal depression above the tip and the fullness of the flap due to underlying fat.

apparent. This was corrected by reopening the scar across the dorsum, removing some of the excess fat, and inserting an L-shaped cartilage. The short arm of the cartilage was passed down through the columella and served as a firm support because it rested on the nasal spine.

This young woman is now able to appear in public without embarrassment. She hides the differences in color with cosmetics and the casual observer notices nothing strange about the nose. The completion of this repair was unnecessarily prolonged. The series of operations should have been completed in a few months with the exception of those which had to be postponed until all the edema subsided.



E. *F.*

Fig. 3.—*E* and *F*, The completed repair after excision of the excess fat and the transplant of an L-shaped cartilage for support.

SUMMARY

Three types of flaps are described: the forehead flap, the tubed-lined arm flap, and the delayed arm flap. Each of these flaps is useful in extensive repairs of the face and mouth. Three illustrative cases are presented.

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101 Bay State Road

INTERNAL WIRE FIXATION FOR FRACTURES OF JAW

Preliminary Report

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IN SOME fractures of the lower jaw, in which interdental wiring cannot be done, a wire—of the Kirschner type—drilled across the fracture line may be an easy and satisfactory method of treatment.

The indication for this internal fixation may be present when the opportune early time for interdental fixation has passed and the fragments have become displaced, with compounding into the mouth, infection, and local sloughing. It also may be considered in edentulous jaws; when there is much comminution and accompanying injury, as in gunshot and war injuries; when many teeth have been loosened or broken; in displaced symphysis fractures; and in fractures at the angle in which the posterior fragment is pulled out and up into the upper buccal fornix by the closing muscles (Fig. 3). This last deformity is one of the worst to contend with, and, if left uncorrected, may result in nonunion of the fragments. It may also prove to be of value in certain separations of the upper jaw.

The internal wire will insure fixation in one plane—that is, the fragments cannot slip up or down past each other. However, they might rotate, in or out, or they might pull apart and, therefore, *the addition of an anterior wire dental arch* will give a second plane of fixation that will prevent rotation and will jam the fragments in impaction so that separation will not occur. If there is a condyle fracture to deal with also, or if normal occlusion cannot be maintained, then there can be the *further addition of interdental fixation to the upper jaw.*

Multiple internal wires can be used for multiple fractures, or to give the second plane of fixation if desirable.

Avoidance of the nerve canal is advisable even though the nerve may have been cut in two by displacement of the fragments. The same is true of any good teeth, and this can usually be done by staying below the canal. When a second wire is placed above the lower one, there is more chance of damage of the nerve and teeth.

An electric power drill is practically necessary, as the hand drill may not give enough speed for easy penetration of the bone. Regular Kirschner wires may be used, but stainless steel wires, recommended by Dr. C. H. Crego in leg lengthening, are cheaper and can be obtained in suitable lengths of thickness from 0.05 inch to 0.08 inch, a three-sided point being put on them.* Bicycle and velocipede spokes also have been used by Dr. Crego.

A further modification is to cut threads all the way along an 0.08-inch wire with a 2-56 die, which is a bicycle spoke threader, and, after it has been drilled

Reprinted from *Surgery, Gynecology and Obstetrics* 74: 227, Feb. 1, 1942.
From the Department of Surgery, Washington University School of Medicine.

*This wire is 18-8 stainless steel. The smallest size to give the necessary stiffness is preferable.

into position, screw regular bicycle spoke nipples or small nuts down against the bone to hold the fragments together. This threaded wire itself may give sufficient tightness without the nipples to prevent separation and is applicable in edentulous patients or any time the dental arch cannot be used (Fig. 4).*

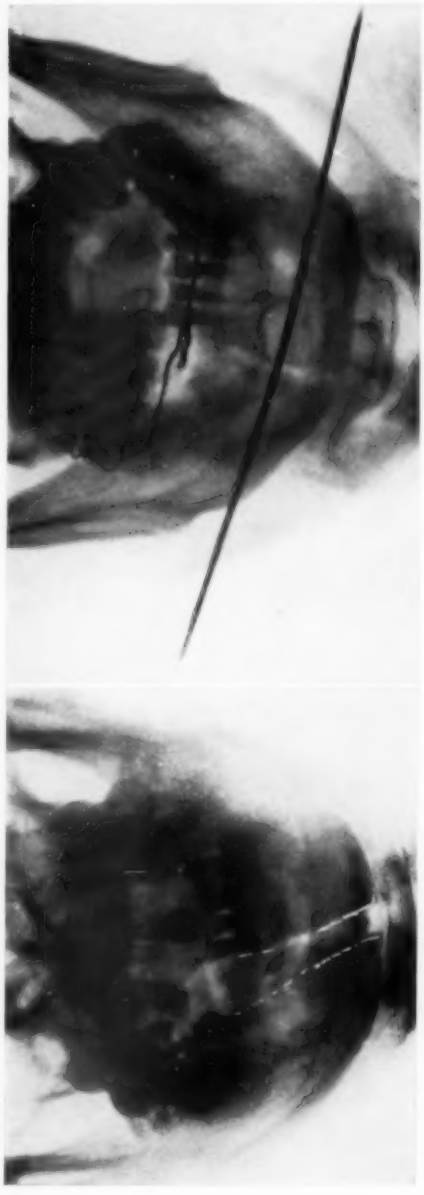




Fig. 1.—Bad comminution at symphysis with only small points of bone in contact, left condyle and many teeth broken. Fixation at symphysis with one internal wire and a second plane of fixation obtained with an anterior wire arch. Jaws wired together because of the condyle fracture opened after four weeks with internal wire still in place.

OPERATION

Local or deep block anesthesia is usually employed. The fragments are aligned with the hands, or an open reduction may be necessary, an elevator being used between the fragments. It is important that reduction be accurate, as only slight adjustment is possible after the wire is in.

*It has been suggested by Dr. J. A. Brown that the threaded wires might be omitted and where fixation against the bone is desired, a hollow cylinder could be slipped over an unthreaded wire down against the bone and held with a set screw put in the end of it.

A puncture incision is made to get the wire in against the bone, and the wire and drill are lined up accurately. Then, perhaps most important of all, the fragments have to be held in accurate position with the hands while the wire is drilled into place. (Little mention need be made of the necessity of care with the drill and wire, and for avoidance of injury to the hands that are holding the fragments.) The wire usually is drilled on through the bone and a small opening is made to let it through the skin on the other side. Secondary internal wires may be needed occasionally (Fig. 2).

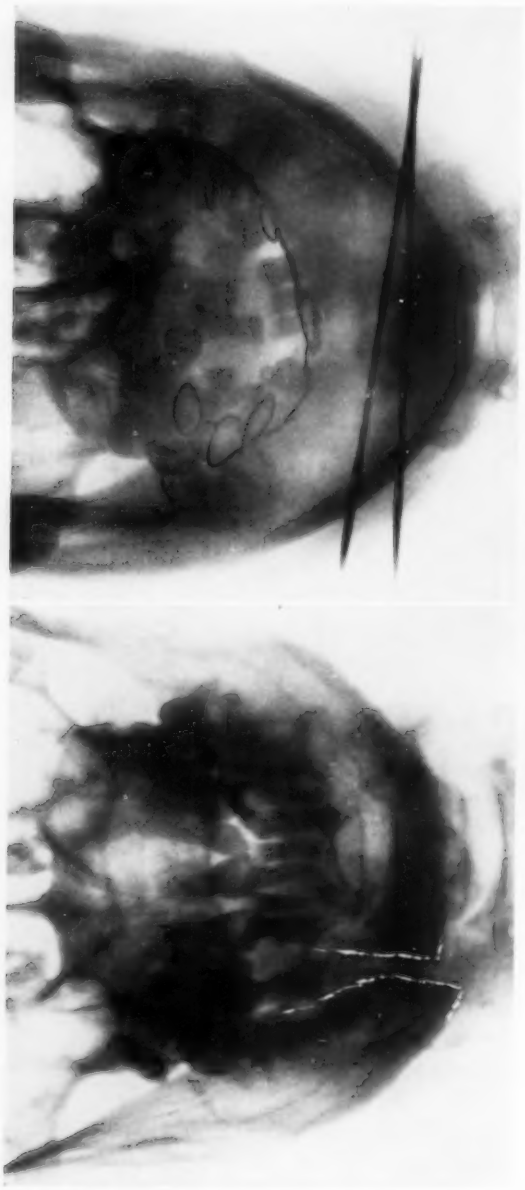


Fig. 2.—Comminuted fracture near symphysis, seen after eleven days, with unsuccessful interdental wiring, infection, and local sloughing. Both condyles also were broken, and many teeth were loosened. Fixation at symphysis with two internal wires. Anterior dental wire arch and wiring to upper jaw, added because of condyle fractures.

The anterior arch wire is applied by putting No. 26 stainless steel wires on posterior teeth on each side, twisting the strands tightly for 2 inches, then twisting them together in the midline and holding them with individual No. 28 wires

around separate teeth. Any other type of arch appliance may be used, but this one requires no added equipment and is usually satisfactory.

This is the wire that should suffice for the second and final plane of fixation and should impact the fragments together over the internal wire (Figs. 1, 2, and 4).

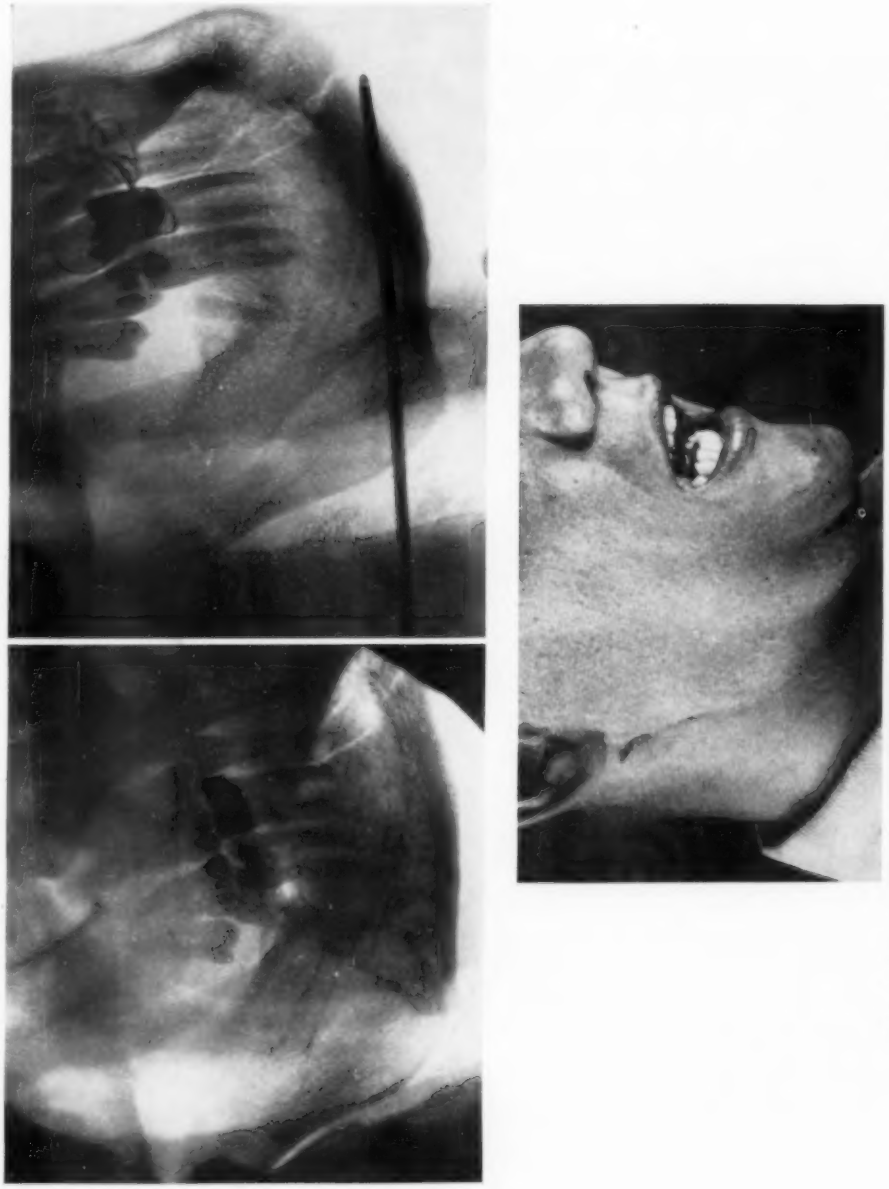


Fig. 3.—Fracture at angle with elevation of posterior fragment and loss of mandibular nerve sensation. Fixation with single internal wire put in from behind and below the nerve canal. Avoidance of open reduction or elastic traction reduction of posterior fragment. Interdental wiring was done because of second fracture in body. At right, mouth open, with wire in place.

Interdental fixation is done as mentioned, if there is some final adjustment of occlusion to be secured or if the condyles also have been fractured. The jaws may be fastened directly together or by any effective method of elastic traction.

In edentulous jaws, when dental plates wired or bandaged in place with the mouth closed will not suffice, a single internal wire or a threaded one as shown in Fig. 4 may be effective as the jaws are usually small from atrophy any-

way. This plan for edentulous jaws seems much less trouble for the patient and surgeon than attempting any rigid fixation within the mouth with screws down into the bone and nerve canal.

Sulfanilamide is used locally in all open wounds and right in the fracture line if it has been separated widely enough to admit the powder. Wounds of the mouth, jaw, and neck, with their marked tendency to infection, make a field of great importance for the use of this drug.

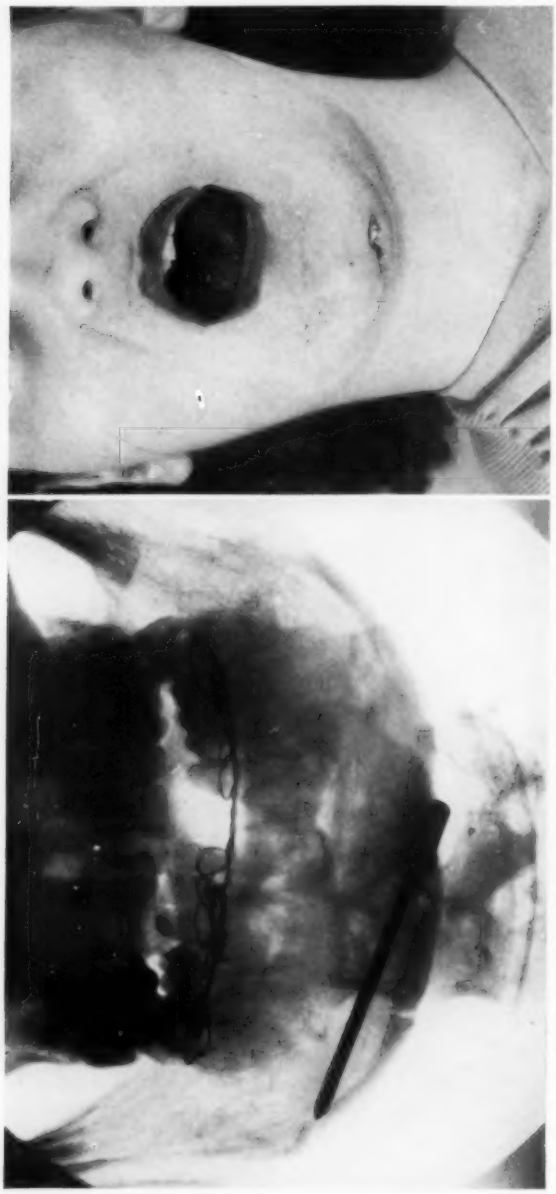


Fig. 4.—18-8 stainless steel wire 0.08-inch threaded with a 2-56 die-cutter which is a bicycle spoke-threader and with regular bicycle spoke nipples screwed on. (Equipment, courtesy Dr. Crego.) In the patient shown the fracture is held with an internal threaded wire and one nipple. The mouth could be opened easily after the operation, and soft food was taken. Anterior arch was put on to hold a separate loose fragment.

Pressure dressings, of soft cotton mechanic's waste, are applied to give support to the soft tissues and prevent, as far as possible, hematomas, hemorrhage, and swelling, and also to lend further support to the bone fragments.

The jaw seems solid immediately and the patient experiences the usual comfort of a set fracture. The ends of the wire are covered and the patients do not

object much to discomfort. In some instances, the wires may be cut short enough to be covered by the skin, but it is probable that they all should be removed finally. Just one or two days are required in the hospital, and some patients can open the jaws and take soft foods almost immediately.

The removal of the wires can be done easily after three to five weeks, depending upon the progress. There may be some irritation around the wires but no serious osteomyelitis should develop.

This plan was thought to be new, but articles on the subject were found by Ipsen and Sobye in Denmark and Meade in Ireland, and these men seem to have been the only ones to have reported it.

In the voluminous literature from the last war and since then, there has been a multiplicity of dental splints, often with emphasis on some contrivance of little fundamental bearing. If this simple direct method of internal wire fixation by drilling a wire across the fragments will help avoid the use of complicated dental splints, overhead plaster-cap traction for elevated posterior fragments, and wide open reductions, it will be worth while.

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AVIATION DENTISTRY

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THE advanced tactics of modern warfare have resulted in increased aerial combat velocities. The strain on the physical stamina of our pilots due to marked variations in atmospheric pressure has resulted in a new specialty of medicine, namely, aviation medicine. In a short space of time, aviation medicine has expanded to the extent where specialized medical fields have been introduced. As one of these specialties, dentistry is growing in importance.

Aviation medicine is concerned with the many abnormal phenomena related to changes in altitude. Some of these are anoxemia, the effect of pressure changes on the blood stream (nitrogen loss in the form of small bubbles in the circulating blood), and the results of pressure changes on the general musculature of the body.

The subject of pressure changes is of particular interest to dentistry. We are concerned with two types of pressure changes: rapid increase in pressure, as in "dive bombing," and rapid decrease in pressure, as experienced in the rapid climbing "fighter" plane. The symptoms of special interest to dentistry which result from rapid increase in pressure arise from disturbances in pressure equilibrium in the middle ear. Other symptoms of dental significance caused by increase in atmospheric pressure may be brought to light in the future.

Since the function of the eustachian tube is the ventilation of the middle ear (the only way we have of equalizing air pressure within the middle ear and the atmosphere), it seems advisable to review briefly the anatomy and physiology of this important structure.

Anatomy.—The eustachian tube (tuba auditiva) is a canal, partly bony and partly cartilaginous, extending from the lateral wall of the nasopharnyx to the anterior part of the tympanic cavity. It is wider at the ends and narrower at the junction of the bony and cartilaginous portions. This narrow portion is called the isthmus.

The mucous membrane lining the eustachian tube and extending backward to line the middle ear is a direct extension of the mucous membrane of the oral cavity and nasopharynx.

Three muscles are attached to the eustachian tube.[1] The *levator veli palatini* elevates the soft palate, narrows the eustachian ostium, and dilates the isthmus. The *tensor veli palatini* tenses the soft palate and opens the eustachian tube. The *salpingopharyngeus* raises the upper and lateral parts of the pharnyx and opens the ostium of the eustachian tube.

Physiology.—As previously mentioned, the eustachian tube drains and ventilates the middle ear. The flutter-valve-like action of the tube, plus the cilia, pushes material from the middle ear to the nasopharynx. The tube is normally closed but may be opened by the contraction of its dilator muscles, thus equaliz-

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ing any differences in pressure between the middle ear and the atmosphere. Contraction of these muscles is produced by swallowing or yawning.

Special Physiology.—Armstrong and Heim[1] carried out laboratory investigations on the eustachian tube under marked variations of atmospheric pressure. These investigations were made on healthy men covering pressure variation rates of from 5.4 to 27.0 mm. of mercury per minute (200 to 1000 feet) through pressure ranges of from 760 to 141 mm. of mercury (0 to 40,000 feet). Since we, as dentists, are primarily interested in sudden increase in atmospheric pressure (dive bombing), only this phase of their work will be discussed. They found that the eustachian tube, acting like a flutter valve, remained closed under all degrees of pressure. One subject was tested to 470 mm. of mercury pressure and the tympanic membrane finally ruptured.

Swallowing and other voluntary efforts to open the eustachian tube in these studies were suppressed, although it was subsequently observed that the voluntary opening of the eustachian tube immediately equalized the ear pressure completely. There is one exception to the statement. After a negative pressure of from 80 to 90 mm. of mercury or more had developed in the tympanic cavity, it was impossible to overcome the negative pressure which held the fibrocartilaginous portion of the eustachian tube closed, and it was then necessary to decrease the atmospheric pressure below that point before the eustachian tubes could be voluntarily opened.

The symptoms in rapid descent when the eustachian tubes were not opened are reported by Armstrong and Heim to be:

"At about 60.0 mm. of mercury negative pressure, the pain in the ear is severe and resembles that of acute otitis media. The tinnitus is marked and there is usually vertigo with beginning nausea. From 60 to 80 mm. of mercury negative pressure, the pain is very severe and radiates from the ear to the temporal region, the parotid gland, and the cheek. Still higher pressures produce agonizing pain, which seems to localize not in the ear but deep in the substance of the parotid gland. Deafness is marked and vertigo and tinnitus usually increase, but the latter may disappear. At between 100 and 500 mm. of mercury negative pressure, the tympanic membrane ruptures.

"This occurrence is a dramatic episode in which the patient feels 'as though hit along the side of the head with a plank,' a loud explosive report is felt and heard in the affected ear, there is a sharp piercing pain on the affected side, vertigo and nausea become marked and collapse or generalized shock follows. With rupture of the tympanic membrane the acute pain quickly subsides, but a dull ache persists for from 12 to 48 hours. Hearing is distinctly diminished and vertigo and nausea may persist for from 6 to 24 hours."

The opening of the eustachian tube will immediately relieve all acute symptoms.

The condition being discussed is already recognized as an occupational disease. The terms "aviator's ear" or "aviation ear," used in the United States, and "barotrauma" or "tonsetrauma," used in Germany, were not acceptable to Armstrong and Heim. They suggested the term "aero-otitis media." Aero-otitis media is defined as, "an acute or chronic, traumatic inflammation of the ear caused by a pressure difference between the air in the tympanic cavity and

that of the surrounding atmosphere, commonly occurring during changes of altitude in airplane flights, and characterized by inflammation, discomfort, pain, tinnitus and deafness.''

AERO-OTITIS MEDIA

The etiology of aero-otitis media is a lack of proper ventilation of the middle ear during atmospheric pressure changes, resulting in trauma to the tympanic membrane. This lack of ventilation may be due either to a *failure* to open the eustachian tube voluntarily when necessary (because of ignorance, carelessness, sleep, etc.) or to an *inability* to open it. This inability to open the eustachian tube is of extreme importance to the medical and dental world. It may be due to acute or chronic upper respiratory infections, nasal obstructions, sinusitis, tonsillitis, paralysis of the soft palate . . . malposition of the jaws.[1]

MALOCCLUSION RELATED TO STENOSIS OF EUSTACHIAN TUBE

Willhelmy[2] was the first to associate malposition of the mandible with stenosis of the eustachian tube, as applied to aviation medicine. He found that six aviators having malocclusion showed distressing ear symptoms when experiencing sudden decrease in altitude. After the mandible had been repositioned, there was complete relief from these symptoms in all of these cases. These cases were treated by increasing the vertical dimension so as to relieve the pressure on the eustachian tube.

Five hundred and forty aviators were examined by Lowry.[3] Eighty-three showed loss of vertical dimension, of which 33 (39.7 per cent) gave histories of faulty ventilation of the tympanum. Twenty-six cases were treated by restoring lost intermaxillary distance with dental splints. All symptoms were eliminated in 34.6 per cent and 53.8 per cent benefited and preferred the use of the splint during flight. Only 12 per cent were unaided.

These data, limited as they are, point out the necessity for further research in this field and stress the importance of dental care and treatment for the men of our air force.

EFFECTS ON THE TEETH

We have not considered the relation of sudden decrease in pressure to dentistry. The symptoms arising from this condition come from the teeth.

In some forms of pulpitis, especially necrosis and gangrene of the pulp, gas is formed by the action of acids, alkalies, and enzymes on the pulp tissue. The chemical agents are produced by bacteria in the pulp. These gases at normal atmospheric pressure may not produce painful symptoms. With rapid ascent, however, the sudden decrease in pressure permits the rapid expansion of the gases, resulting in extremely painful conditions. Root canals, which may have been so filled as to leave large air spaces, will give no symptoms on the ''ground'' but may prove quite troublesome at higher altitudes. It is reported that poorly filled teeth ache at altitudes above 25,000 feet.[4] This emphasizes the need for a careful dental examination of all pilots. These examinations should be made at frequent intervals with the aid of dental x-rays and the electric pulp tester.

The need for building an air force second to none has been universally recognized. It is our responsibility to see that the men who fly our planes do not enter the field of combat handicapped. They must be physically fit. All of the resources of medicine and dentistry must be pooled to meet this end. Medical science is now being utilized. Dental science must assume its responsibility by cultivating a new field—Aviation Dentistry.

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FRACTURES OF THE JAWS

An External Traction Appliance

Harry L. Bisnoff, D.D.S., Jamaica, N. Y.

IT IS the business and duty of military men to organize all forces for defense and full offensive if necessary. In this effort, it is the civilian's duty to be helpful directly and indirectly in every possible way. It is also important to be fully organized to treat and rehabilitate our military personnel in any emergency and for all contingent injuries. This must be done as speedily and efficiently as possible. This efficiency is enhanced if a given condition can be treated by the least number of attendants and with the least inconvenience of transportation of the injured.

It is the duty also of those not privileged to serve with the armed forces to offer their talents or the products of their talents. We are confident that the principles of democracy, which forms the basic foundation of our government, are exercised by the officials of our armed forces whose duty it is to survey and appraise the possibilities of procedures or material offered. In the progressive growth and changes of our war machinery and the large number of civilians directly engaged with military personnel, all offerings should be viewed from an objective, not a personal, point of view, regardless of whether the offering originates from a civilian or a military person.

The present war again calls forth our resourcefulness to cope with the increased jaw and head injuries. The surgeon, orthopedist, and plastic surgeon, each alone and all together, have a grave responsibility to rehabilitate those unfortunates who have fallen victim to the blasting and destructive methods of modern warfare. Whether one is to rehabilitate the injured for return to military service, or to usefulness in civilian life, it is no less the dentist's responsibility to coordinate his skill and knowledge with the others to help these sufferers. It is a sufficiently sad commentary on our modern age that slaughter and maiming is so widespread. It would be just as sad if modern science would not employ every possible and available means for aiding recovery and doing everything within its reach to return normal facial expressions and function to those who are injured. The drab records of the last war and the rosters of veteran hospitals give mute or vocal evidence of men who left active circles of society amidst cheers in the patriotic farewells, never to return to their society circles except as objects of sympathy. A man who had part of his face or jaw shot away or who suffered severe fractures resulting in disfigurement becomes a hermit even in a metropolis.

From the limited information available, the incidence of head injuries in the belligerent countries of Europe is high. The last war had its toll, but there is every reason to believe that with the magnitude of modern warfare the numbers will be higher and possibly, too, the injuries more severe. The writer has had occasion to see on the continent of Europe men whose facial deform-

ities were so grotesque, as a result of gunshot and other war injuries, that one wonders what determination these souls have to give them the impetus to fight on after the cloud of gunpowder and the insanity of hate had cleared. As a personal conclusion, I could say only that these men have faith. This faith which they had in those administering toward their cure giving rise to a faith accelerated by inherent hope that some day they may again face society as other human beings do, and that they too may exercise the functions of the jaws and not feel reluctant to show their facial features.

There are numerous methods of treating jaw fractures. They vary in their application as does also the skill of those applying them. In the catastrophe and wholesale mauling which is now visited upon the military as well as civilian population, we must be prepared to treat facial and jaw injuries wherever and whenever they occur. Multiple injuries to the jaws, severance of continuity of the body from the ramus of the mandible, causing lack of control of the tongue, calls for quick treatment. Horizontally fractured maxillary bones, disconnected mandibular segments, or comminution of the symphysis may require the application of external appliances for traction, relief, coaptation, or to overcome occlusion of respiratory passages.

No one method or appliance can be a panacea for all types of injuries. An experienced and skilled technician may by his resourcefulness substitute one method for another under necessity. Vulcanite, metal, or acrylic splints, arch bars, inter- or intramaxillary wiring, or the implantation of steel pins or screws into severed segments, all are as useful as the relative skill of the operator. Each of these have been used with numerous modifications and relative success. For each we can name advantages or disadvantages. The growing tendency has been to use such methods as will permit visibility and accessibility to the occlusion. Some splints have been useful for fixation, but resulted in a malocclusion which presented a problem parallel to the initial condition.

Regardless of the choice or availability of intraoral methods for treating fractures of the jaws there has always been a need for external application of support or traction in some cases. Often such treatment is needed most urgently, and where technical facilities for individually constructed appliances are not easily accessible. The use of plaster head casts as cranial support for external traction wires in certain types of jaw injuries has played an important role in the treatment of maxillary and mandibular fractures. The use of this form of retention and traction requires special skill for construction. The wires have to be placed in position into the plaster while in the making and in such positions, as the operator predetermines in his mind's eye, as to give the proper leverage for traction in the desired direction. These wires may require variation from original position, and unless auxiliary wires have been provided, such variations may be difficult or impossible.

Numerous patients have been treated ingeniously by such experts as Ivy, Woodard, Richison (U. S. Navy), Stout (U. S. Army), Cope, Straith, Waldron, Balkin, who have used the plaster head casts and the general principle of cranial retention for traction support. They, however, like others, have over the years modified some advocated techniques and retained others. Numerous

attempts have been made by many, including the author, to create an appliance that could replace or modify the plaster cast as a cranial support for variable traction attachments. Some incorporated metal plates into plaster, or metal and leather or sponge rubber, or other bulk which did not eliminate but rather replaced the disadvantages of the cranial plaster cast. The basic requirements are for something light and flexible, an appliance that can be changed for varying head sizes, with basic major traction wires for most cases as outlined. An added advantage is the possibility that men with resourcefulness can easily make additional attachments of ordinary wire to fit into the headgear, if they wish.

Today the world is faced with many changes. This war has created a need for quick action and mobility. Speed of changing positions of military placements requires procedures of therapy and treatment parallel to the needs. The treatment of special cases should not be limited to the skilled few. We need procedures that can be applied by many and do not require extensive special training. The appliance demonstrated here can shorten the time between injury and instituting treatment; it reduces the need for transporting injured to distant points for initial treatment; it makes possible the early application of treatment by men of average skill close to the scene of injury; it may be available for use wherever and whenever needed in one mobile unit; it can be used over again, and corrections or changes in angles of traction can be accomplished in a few moments if necessary.

An outstanding advantage of this appliance is the fact that it eliminates the need for specially constructed plaster head casts as support for the traction wires. The construction of plaster casts is time consuming, requires special skill and facilities in making, may require shaving of the head, and at its best is not very desirable from a sanitary standpoint. In case of scalp injury, a plaster cast cannot always be applied except in certain cases where windows can be cut in the cast. In such cases treatment may have to be deferred, whereas with the headgear presented here, which leaves a good deal of the head uncovered and is easily removed for treatment, such delay is not necessary. Should tissue lacerations involve the part to be covered by the headgear, a treatment pad of felt or gauze laid around the periphery of the involved area, similar to an orthopedic or bunion pad, will permit wearing of the headgear over it.

DESCRIPTION OF APPLIANCE

The traction fracture appliance herewith presented consists of the following parts, shown in Fig. 1:

1. Leather headgear.
2. Retention pocket (leather) which is part of headgear and has perforations to receive traction wires.
3. Pocket which holds ligature and wire for ligating teeth or jaw for attachment to traction wires.

4–5. Shows back buckles for strapping on headgear. These are on swivel rivets to allow for variation.

6. Top straps, for use if necessary, to give added retention against slipping.
7. Metal loops through which straps are placed.

8. Chin support—leather with felt base.
9. Anterior strap for chin support attachment.
10. Posterior strap for chin support attachment.
11. Anterior traction bar. Dotted line shows how horizontally shaped end fits into pocket through perforation.
12. Posterior traction angles of which there is a right and left; dotted line shows how longer horizontal part fits into pocket anteriorly, and shorter end posteriorly.
13. Indicates end of wire, ligature, or any intraoral attachment which is attached to the teeth or jaw extends for attachment of traction wire or band.
14. Elastic or wire traction from jaw to anterior bar. Similar traction can be applied from traction angle (12) to angle of jaw or ramus for posterior traction.
15. Attachment wires which can fit into any desired position to provide traction of the maxilla in an upward position, varying as needed, close to the face or at a distance from it.

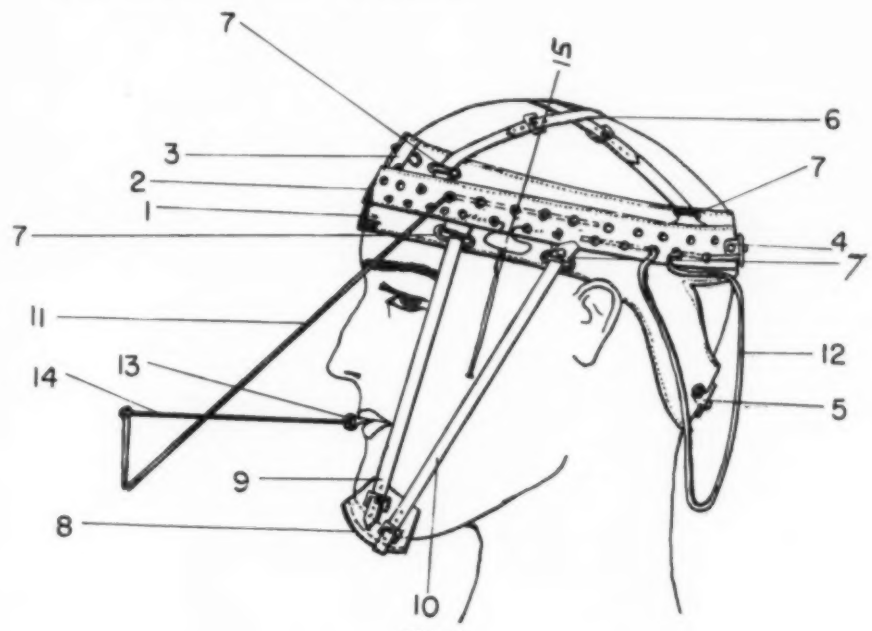


Fig. 1.

Directions for use of the appliance.—The headgear is strapped on the head and buckled with one hold under the occiput and the other over the back part of the crown. For anterior traction place the ends of the larger traction wire into the fifth hole on each side and insert into the leather pocket. The position may vary according to width of head.

For lateral traction or traction at an angle off center, shift the wire to other holes, which would bring one side as many holes closer to the center as the other is moved backward. After the teeth are ligated with wire or ligatures, or an arch wire is attached in a convenient way to the jaw or jaws, traction is created by twisting a connecting wire or by attaching a rubber band to the bar. If posterior traction is desired at the angle of the jaw or

ramus, place the traction angle into holes of headgear, inserting the longer end of the traction angle first, using the third or fourth hole from the back and pushing it into position toward the front of the head. The shorter end is placed in the nearest hole to the back into which it fits conveniently. The bars may be attached while the appliance is on or off of the head; it holds taut and provides a hold for anterior and posterior traction. The attachment from the rod to the part to which the force is to be applied may be with wire, elastic, or any form desired. Any or all of these attachments may be used at one time as the case warrants, and where necessary, the wires may be bent by hand to conform more accurately to specific head forms, though in most cases it may not be necessary.



Fig. 2.



Fig. 3.



Fig. 4.

The chin support is attached to the headgear with metal loops. The back one swivels, to permit change in direction of pull or hold. The shorter tape is first drawn through the back part of the buckles on right and left. The ends are brought through the loops on the swivel on both sides and returned to be attached to the buckles. This provides a firm grip under the chin.

The following illustrations show the use of this appliance for various purposes. Fig. 2 shows the application of the chin support. The distal as well as the vertical tension can be varied. It also shows the use of posterior and anterior tractions. Fig. 3 shows the appliance adapted to exert anterior and posterior traction without the use of chin support. Fig. 4 shows the use of the appliance to give chin support only, and to apply traction forward. Fig. 5 shows the use for chin support without any traction rods, and Fig. 6 shows its use for chin support and lateral traction by means of an adjustment, placing the bar on the side. The position of this bar, of course, can be varied, placed anteriorly, distally, right and left.



Fig. 5.



Fig. 6.

SUMMARY

An appliance has been presented which will enable more men to exercise their talents in treating complicated jaw injuries. It is hoped that by the use of it, great benefit will accrue to the victims who with it can be treated more promptly and without the need of specially constructed appliances for each individual case. Furthermore, the treatment of such cases by many more men in our medical and dental corps will lessen the demand on the experts who are less numerous and not always available.

With the call to service of so many men skilled in oral and plastic surgery, it would appear that a ready-made, mobile unit which may be available at casualty stations, ambulances, and hospitals, when needed, will facilitate the treatment of jaw injuries.

89 153RD STREET

THE PROBLEM OF TEETH IN THE LINE OF FRACTURE OF THE MANDIBLE

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TEETH in the line of fracture of the mandible present a problem. Variation of opinion has been great enough to create two schools of thought, one school believing that teeth involved in a line of fracture should be permitted to remain, even at the risk of infection, the other school believing that such teeth should be removed in order to prevent infection.

A review of the literature tends to leave a doubt as to the proper procedure to follow.

Ivy and Curtis[1] state: "Teeth whose roots are exposed in the line of fracture, or which have been markedly loosened, should generally be removed, provided that this can be done without too much traumatism to the fracture, because such teeth usually give rise to infection sooner or later. However, in certain cases, it may be advisable to retain such a tooth for a time, even at the risk of infection."

Brophy[2] states: "If any of the teeth are loosened by accident, they should be retained if it is possible to do so without taking too much risk. Teeth which are completely or nearly loose from their attachment are liable to set up an infection, if they are not aseptically treated before being replaced."

Padgett,[3] discussing fractures at the angle of the jaw, states: "When a lower third molar comes in contact with the upper third molar in a fracture at the angle, the lower third molar very often can be used advantageously to hold the posterior fragment down and back. If the tooth suffices for this purpose, it is by far the simplest method of retaining the posterior fragment in place. After two or three weeks . . . the tooth may be extracted."

DaCosta[4] states, "As a rule, push loose teeth into place and put back detached ones; but occasionally a tooth obstinately prevents perfect approximation, and if it does, it must be removed."

Meade[5] states, "If clinical examination shows a tooth loose or interfering with proper adjustment of the fragment, it should be removed."

From these discussions, no set of rules can be established which will determine when a tooth in the line of fracture should be extracted. If certain cardinal principles are to be evolved, a number of questions arise, the answer to which may be the decisive factor in the selection of the proper procedure.

The questions which present themselves to be answered are as follows:

1. Is the root or crown of the tooth involved by the injury?
2. Is the tooth single- or multirooted?
3. Is the tooth fractured longitudinally or horizontally?
4. In a multirooted tooth, is more than one root fractured?
5. Is the tooth luxated?
6. Is luxation complete or incomplete?

7. Is the tooth devitalized?
8. Is it abscessed?
9. Is there a root only in the line of fracture?
10. Does the root or tooth prevent good approximation of the fragments?

FRACTURE OF CROWN OF SINGLE-ROOTED TOOTH

Fracture of the mandible may result in complete loss of the crown of a single-rooted tooth with the retention of the root within the line of fracture. Whether such a root should be removed will depend on the vitality of the tooth before fracture, on the evidence of pre-existing infection of the apex or periodontium and on the anatomic structure of the root.

If the tooth was vital before the fracture, with little or no evidence of active periodontal infection, the retention of such a root is indicated, if root canal therapy is instituted following the extirpation of the remaining pulp structure. This is especially advisable where there is a full complement of teeth in a healthy mouth. Later on the root can be utilized for a restoration.

If x-ray evidence reveals an abnormal root curvature or marked hypercementosis in a previously infected tooth, and the attempt to remove such a root would cause further separation of the fragments and traumatism to the soft tissues, it should be left in place, if it is possible to establish root canal drainage.

FRACTURE OF CROWN OF MULTIROOTED TOOTH

If the crown of a vital multirooted tooth is fractured off entirely, and the roots are retained in the line of fracture of the jaw, the roots may be left in place if there is no interference with good approximation of the fragments.

If there has been pre-existing apical infection and proper root canal drainage cannot be established, the roots should be removed if excessive trauma can be eliminated. If subacute or acute infection is imminent, the roots must be removed. It is far better to resort to mechanical approximation of the mandibular fragments than to risk diffuse osteomyelitis or cellulitis.

If there is a fracture through the bifurcation of such roots, they must be removed, but further separation of the fragments must and can be avoided. Where the roots have been divided through the bifurcation, unless there are apical abnormalities, each root can be taken out separately without having to use force in their removal.

In the presence of extreme curvatures or hypercementosis, the already existing separation of the fragments will facilitate their removal. The precaution necessary for the removal of such roots is a walling off of the area to be operated on, by gauze and the use of suction to prevent further seepage of mucus, saliva, and debris into the line of fracture.

LONGITUDINAL FRACTURE OF A TOOTH

When a single- or multirooted tooth is fractured longitudinally through the crown and root, it should be removed. It is a simple matter to extract each fragment separately without causing excessive trauma or separation of the mandibular fragments.

HORIZONTAL FRACTURE OF A TOOTH ROOT

Horizontal fracture of a root presents a different problem. Vitality, abnormalities, and infections are factors to be considered.

There are a number of cases on record describing horizontal fracture of the apical or middle third of a root, without fracture of the jaw, in which vitality tests made years later proved such teeth to be vital, and x-ray examination did not disclose apical rarefaction.

Thoma[6] states: "In young patients, healing of the fragments occurs in absence of infection by ingrowth of fibroblasts and odontogenic cells between the fragments. Osteocementum forms, and if the tooth is immobilized, restores continuity of the root."

SINGLE-ROOTED TEETH

If a noninfected, single-rooted tooth sustains a horizontal fracture at or below the middle third of the root and is in the line of a mandibular fracture, it should be immobilized at the time the jaws are immobilized. Should such a tooth become devitalized subsequently, root canal treatment and a window operation for the removal of the apical fragment can be performed, if root union has not taken place.

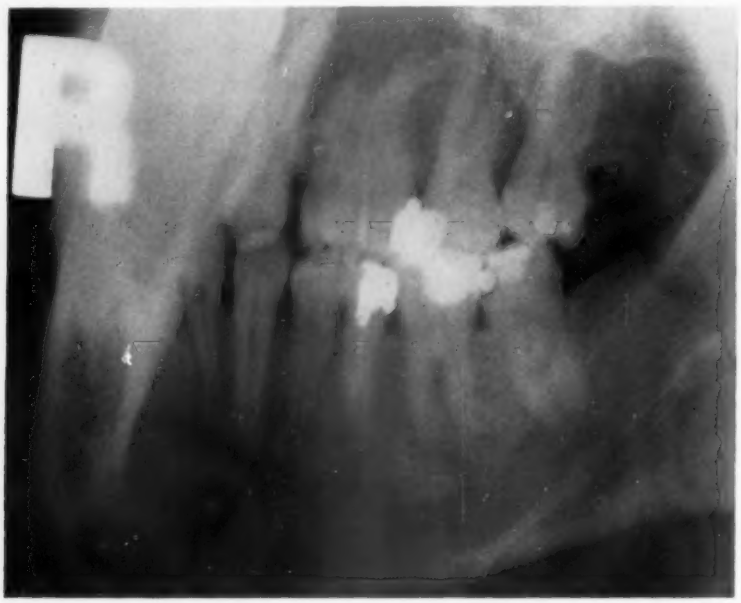


Fig. 1.—Compound, complete, oblique fracture of right side of mandible with horizontally oblique fracture through the apical third of the first premolar (July 5, 1933).

Case History.—M. F., male, aged 30, received a blow in the lower right jaw, causing a compound, complete, oblique fracture of the mandible and a horizontally oblique fracture through the lower third of the right first premolar. The superior section of this tooth was loose, but in good position (Fig. 1).

The jaw was immobilized by the use of intermaxillary wires and the fractured premolar was banded and immobilized.

An x-ray taken one year later disclosed an unbroken lamina dura (Fig. 2). Reactions to electro-vitality tests were within normal limits.

A chronically infected root of a tooth with horizontal fracture of the root in the line of mandibular fracture should be permitted to remain, if its removal will cause further separation of the fragments or tissue trauma. Such a tooth, however, should be kept under observation and symptomatic treatment instituted if acute infection is imminent. It can be removed at some future time.

MULTIROOTED TEETH

When horizontal fracture of the roots of a multirooted tooth occurs, it should be permitted to remain, by all means, if the upper portion of the tooth can be stabilized. Multirooted teeth act as dovetail splints, helping to secure good approximation of the mandibular fragments, if acute or subacute infection can be prevented (Fig. 3).

When a multirooted tooth is fractured so that one root remains in the line of fracture and the rest of the tooth is subluxated, the tooth and the retained root should be carefully removed (Fig. 4).



Fig. 2.—Case shown in Fig. 1, one year later. Normal lamina dura.

If it becomes necessary to remove a multirooted tooth with horizontally fractured apices, utmost care must be used to avoid excessive trauma. It is not an easy matter to remove the apical fragments of a multirooted tooth without creating some separation of the bone fragments. The latter permits entrance of blood and saliva into the parts. Acute infection is more apt to follow such a procedure than when the apices are left in the line of fracture. If the root and fragments are removed, sulfathiazole powder or a mixture of sulfanilamide and sulfathiazole should be sprinkled into the socket.

LUXATED TEETH

A tooth in the line of fracture may be partially or completely luxated, rotated, or fractured, partially luxated and rotated. A partially luxated tooth, the crown of which is in good condition and serviceable, should be carefully placed back in its socket and kept immobilized. Such a tooth should be under constant observation during the treatment of the fracture. Should infection ensue, it could then be removed.

Case History.—R. L. S., male, aged 20, was hit by a jack handle, receiving a comminuted, complete, compound, oblique fracture through the right cuspid area and a complete, compound fracture through the left angle of the mandible. The right mandibular cuspid had been forced out of its socket to the distal fragment (Fig. 5).

The jaws were immobilized by intermaxillary wiring. As the occlusion stabilized itself, there was gradual reduction of the cuspid into its socket (Fig. 6).

A completely luxated tooth whose attachments have been entirely severed should not be replaced. Replantation of teeth has not proved successful. Even though the replacement of such a tooth may not be followed by immediate infection, resorption of the root invariably takes place.



Fig. 3.—Multirooted tooth in line of fracture acting as a dovetail splint and preventing upward pull of the posterior fragment.



Fig. 4.—Fracture of multirooted tooth with mesial root in line of mandibular fracture. The third molar will prevent excessive upward pull of the posterior fragment following the removal of the second molar.

However, if the replacement of a completely luxated tooth will materially aid in creating good approximation, the tooth may be replaced into its socket

following the removal of the pulp, filling of the root canal and immobilization of the tooth.

An interesting case of root resorption following replantation of a completely luxated tooth in the line of fracture is illustrated by the following history.

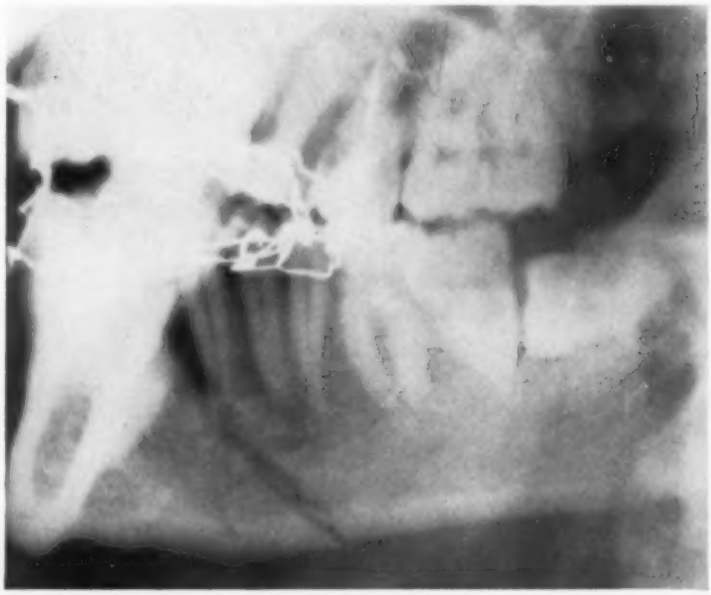


Fig. 5.—Subluxation of mandibular cuspid which reduced itself as the mandibular fragments were brought into close approximation (Aug. 5, 1937).

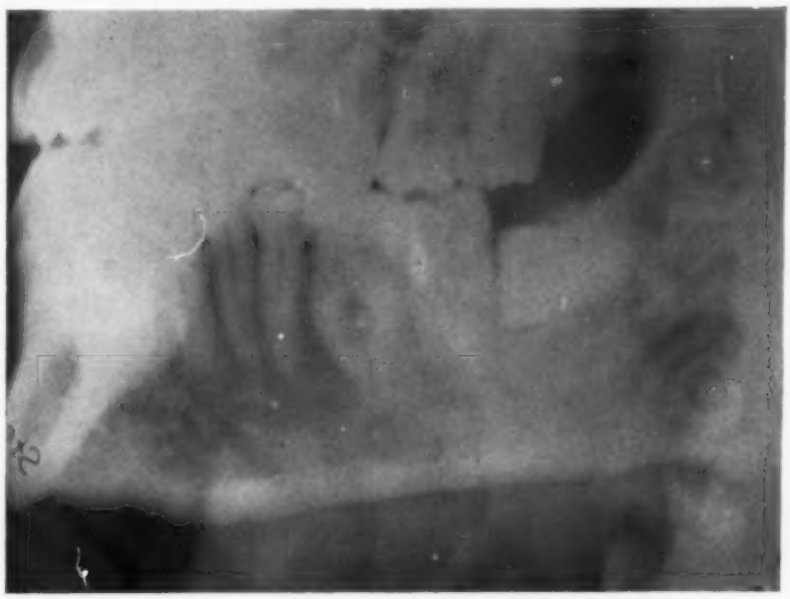


Fig. 6.—Cuspid in good position, vital and unbroken lamina dura (Feb. 27, 1939).

Case History.—W. K., male, aged 7, fell from a chair to the floor, injuring his upper lip and gums, fracturing the anterior maxillary alveolus and completely luxating the left central incisor. He bled profusely from the lip, gums, and socket.

He was first seen three hours after the accident. His mother was sent home to look for the tooth. She was successful in finding it and brought it back to the office.

Examination disclosed two lacerations of the upper lip and a laceration of the gingival mucous membrane, with a protrusion of a section of completely detached labial alveolar process. The left central incisor was missing, and there was bleeding from the socket.

X-ray examination made after the protruding process was removed revealed a radiolucency in the area where the fractured process had been removed (Fig. 7).

Hemorrhage was controlled and the socket was packed to keep it open. The tooth was placed in a 1:2,000 solution of bichloride of mercury. The pulp of the tooth was removed from its chamber and root canal through the lingual surface. The root had not been fully developed and was funnel shaped. The root canal was sterilized with the bichloride, dried and filled. The apex was built up with the filling material.



Fig. 7.



Fig. 8.



Fig. 9.

Fig. 7.—Condition of left central socket after detached fragment of protruding alveolus was removed (Aug. 20, 1936).

Fig. 8.—Root canal filled, tooth banded and immobilized (Aug. 20, 1936).

Fig. 9.—Resorption of root (Jan. 2, 1940).

When the root canal filling was thoroughly set, the packing in the socket was removed and the tooth inserted, banded, and immobilized (Fig. 8). The band was removed two months later.

Frequent x-rays disclosed the gradual resorption of the root until only the coronal part remained and seemed to be held in position by the root canal filling (Fig. 9).

SUBLUXATED AND ROTATED TEETH

Teeth which are subluxated and rotated in the line of fracture and have some attachment should be replaced and immobilized. Such teeth do not always become devitalized.

Case History.—I. L., male, aged 22, was hit by an automobile, sustaining a longitudinal fracture of the right mandible and loss of the cuspid, first and second premolars, and first molar. The second molar was out of its socket but attached to the superior mandibular fragment.

The parts were put into approximation and the second molar placed back into its socket. The tooth and jaw were splinted (Fig. 10).

Five years later, the tooth was in good position, vital and had been utilized as an abutment for a removable bridge.

CARDINAL PRINCIPLES

There are several cardinal principles involved in whether a fractured, partially or completely luxated tooth should be left in the line of fracture:

1. The mouth and teeth must be clean.

2. The arch should contain all or nearly all of its complement of teeth. If many teeth are missing, the loss of one more will not make any material difference unless it is an aid to good approximation.

3. If a tooth acts as an agent helping to keep the fragments in good approximation, it should be retained and placed under observation.



Fig. 10.—Incompletely luxated tooth in line of longitudinal fracture of the mandible.

4. Any tooth, the removal of which will necessitate soft tissue trauma or cause further separation of the fragments, should be retained, kept under observation, and removed at the first symptoms of oncoming infection.

5. Any luxated tooth in the line of fracture which obstructs good approximation and occlusion, after replacement, should be removed.

6. As little surgery as possible should be resorted to at or near the line of fracture until union has taken place. The chances of infection are greater when manipulation of the fractured fragments permits seepage of saliva, mucus, and debris to gain access into the line of fracture.

7. An acutely or subacutely infected tooth must be removed to prevent possible osteomyelitis or cellulitis.

SUMMARY

The problem of teeth in the line of fracture of the mandible is discussed. An attempt is made to answer the problem of fractured, luxated and rotated teeth in the line of fracture. Several cardinal principles are laid down governing the removal of such teeth.

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INTERNAL WIRING FIXATION OF FACIAL FRACTURES

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DUE to the increased number of extensive facial fractures within the last few years, there is an obvious need for a method of treatment of such fractures which may be quickly applied and one which affords complete immobilization. After using numerous types of extraoral appliances, including those attached to plaster headcaps, for immobilizing fractures of the maxilla and other facial bones, the author has found these appliances are complicated, their preparation and application are time consuming, they are cumbersome and uncomfortable for the patient, and they require close watching and repeated adjustments on the part of the surgeon. The fact that practically everyone treating these fractures has a different type of extraoral appliance suggests that this method is not entirely satisfactory.

During the past eight years, we have treated eighty-five fractures of the maxilla. The occurrence of head and other facial injuries with fractures of the maxilla is shown in Table I.

As may be seen, there were three fatalities in this series, all three of the patients having had an associated brain injury. Two died of concussion and contusion of the brain, and the third of cerebral meningitis. All expired before their physical condition would permit manipulative procedures for reduction of the facial fractures.

Until two years ago, some type of extraoral appliance was generally employed in these cases. Since then, open reduction and fixation by wiring of the fractured parts to the neighboring unfractured bony structures have been carried out in all cases wherein immobilization was required, with three exceptions; in these three, open reduction was contraindicated and it was necessary to resort to the use of an extraoral appliance.

This method not only meets the requirements of facility of operation, complete immobilization, and sound surgical principles, but is applicable to practically every type of fracture of the facial bones. The procedure may be carried out with only a pair of pliers, a small drill and dissecting set, and a spool of fine stainless steel wire. Since complete immobilization is obtained, repeated adjustments are unnecessary and the patient is spared much discomfort and inconvenience. Patients are usually able to resume their activities after the tissues have recovered from the acute stage of the injury and when healing is complete the wires are easily removed. Regardless of how extensive the fractures, immobilization by this method has proved far simpler and more satisfactory than by the use of extraoral appliances attached to plaster headcaps.

Undoubtedly, in the exceptional case, extraoral appliances are essential and therefore should be included in the armamentarium of every surgeon who does this type of work. In the presence of infection, particularly in compound fractures, open reduction is definitely contraindicated. Even here, however, an extraoral appliance may be required only for temporary immobilization;

Reprinted with additions from *Surgery* 12: 523, 1942.
From the Department of Plastic and Oral Surgery, University of Tennessee.

after the infection subsides, one may remove the appliance and wire the fragments together.

The treatment of fractures of the facial bones must, of course, be individualized. In greenstick fractures of the maxilla with only slight malocclusion of the teeth, for example, immobilization by open reduction or extraoral appliances may not be necessary. Motion of the lower jaw against the upper will generally shift the teeth into occlusion.

TABLE I

DISTRIBUTION OF EIGHTY-FIVE FRACTURES OF THE MAXILLA AND ASSOCIATED INJURIES (1934 TO 1941)

YEAR	NUMBER OF CASES	FRACTURE OF THE MANDIBLE	FRACTURE OF THE ZYGOMA	FRACTURE OF THE NASAL BONES	FRACTURE OF THE SKULL	FACIAL LACERATIONS	INFECTION WITH DRAINAGE	DEATHS
1934	4	1				3		
1935	8	3	3		1	6		1
1936	5	1	3	1		3		
1937	4	1	3	1	1	1		
1938	12	2	3	3		9	1	
1939	13	2	3	3	1	10		1
1940	17	2	2	4	1	11	2	1
1941	22	77	5	4	1	17	2	
Total	85	19	22	16	5	50	5	3

Diagnosis.—In acute injuries of the face, the surgeon should have no difficulty in recognizing gross fractures of the facial bones, even without roentgenograms. Although roentgenograms afford valuable information and should be made in all cases as soon as the condition of the patient permits, as a rule, an accurate diagnosis may be made by careful inspection and palpation. Examination by palpation should be carried out on both sides at the same time, with special attention to any asymmetry, irregularities, or crepitus.

In fractures of the maxilla with downward displacement, inspection will reveal an elongation of the middle third of the face; if the maxilla has been depressed backward as well, the patient will have a "dishpan" face, particularly if the nasal bones are also depressed, and the teeth will be in malocclusion.

In any facial injury, one should always determine whether the upper jaw is movable. This is easily accomplished by grasping the upper teeth between the fingers of one hand while supporting the back of the head with the other. Motion may be up and down or from side to side. When up and down, movement of the infraorbital ridges may often be detected. One should also observe whether motion of the lower jaw is limited on opening and closing or in the shift from side to side.

Roentgenograms should be made routinely in the posterior-anterior and lateral views, and should include all the facial bones of both the upper and lower jaws. Some fractures, especially those of the temporomandibular joint, may not be demonstrated in these routine films; when such fractures are suspected, roentgenograms in special views should be made.

Anesthesia.—If the bony fragments are not impacted and reduction is possible by manipulation, the procedure may be carried out under local anesthesia. In more difficult cases a general anesthetic is necessary, the type depending largely upon the skill of the anesthetist. Intratracheal anesthesia and sodium

pentothal are both satisfactory, but should be given only by one well-trained in their administration. When there is any doubt as to the choice of the anesthetic, the use of ether by the open method is advisable.

Technique.—After the diagnosis has been made, one should visualize the fractured parts in their architectural relationship to the normal bony structures, without regard to the overlying soft tissues. The treatment then should be relatively simple. The soft tissue wounds should, of course, be treated in the usual manner.

Fractures of the maxilla are rarely encountered alone, rather, they are generally associated with fractures of one or more of the other facial bones, including the mandible. Since the maxilla is the foundation structure, accurate apposition and immobilization of this fracture is of prime importance; once these are accomplished, immobilization of the secondary fracture offers little difficulty.

In carrying out this method of open reduction and fixation of fractures of the facial bones, it is necessary to make an incision at only one or two sites: overlying the infraorbital ridge, or at the lateral margin of the supraorbital ridge, depending upon the bones involved. In the event of a laceration over either of these areas, the wires may be inserted through the wound.



Fig. 1.—*A*, Complete bilateral horizontal fracture of maxilla; *B*, maxilla elevated and maintained in normal position with wires extending from the infraorbital ridges to the upper teeth.

In a simple bilateral fracture of the maxilla (Fig. 1), a small incision is made over the infraorbital ridge on either side. A hole of sufficient size to accommodate a No. 25 or 26 stainless steel wire is bored through the infraorbital ridge. The wire is then threaded through the opening, looped over the ridge, and both ends are passed together along the anterior wall of the antrum into the upper sulcus over the second molar teeth, where they are caught with a hemostat. One is surprised at the ease with which the wires are directed to the desired point of exit without the use of a guide. The fractured bone is then elevated to its normal position and the wires are drawn taut and fixed to one or more of the teeth. The use of the loop around the infraorbital ridge is much more simple than tying the wire and its subsequent removal is easily accomplished.

If the patient is edentulous, the wires may be attached to the false plate, provided it is intact; otherwise, dental wax may be molded around the alveolar ridge and over the hard palate, the wires drawn across the palate and tied in the midline, and the ends imbedded in the wax.

Once the wires enter the contaminated field of the mouth, they should not be drawn upward through the soft tissues. If removal is necessary, the loop should be cut and the wires withdrawn from below.

In fractures of the maxilla associated with comminuted fractures of the infraorbital ridge (Fig. 2), it is sometimes necessary to immobilize the major fragment of the ridge to the outer half. This may be done through the same soft tissue incision. An additional hole is drilled through the medial fragment and a small loop of wire is inserted through the two holes and tied. The smaller fragments, after restoration to their normal position, will usually remain in place, being supported by the immobilized large fragment. Following wiring fixation of the infraorbital ridge, intra-antral packing with gauze or other substance is unnecessary.

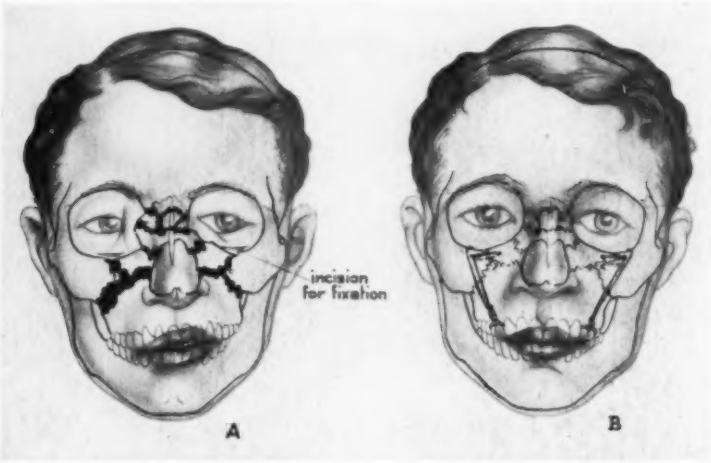


Fig. 2.—*A*, Complete bilateral fracture of maxilla with comminuted fractures of nasal bones and infraorbital ridges. *B*, Maxilla held in position by wires from the malar bones to the upper teeth; lower fragments of infraorbital ridges immobilized by separate wiring; fixation not necessary for smaller fragments.

Should the maxilla be separated in the midline, the teeth on the fractured side are fixed to those of the sound side. In many cases a simple loop of wire is sufficient, though in more complicated cases, with loss of the teeth, an arch band may be required (Fig. 3).

For reduction and immobilization of fractures of the maxilla with associated fractures of the zygoma or malar process (Fig. 4), an incision is made over the ridge of the frontal bone lateral to the supraorbital rim, just above the zygomatic-frontal suture line. With an elevator, the periosteum is separated from the frontal bone and a small hole is drilled through the ridge. A wire is threaded through the opening, looped over the ridge, and the two ends are passed beneath the temporal surface of the malar bone, making their exit in the upper sulcus in the region of the first or second molar. The displaced bones are elevated to their proper positions and the wires are tied to the teeth, exerting an upward and outward pull on the malar bone, holding it up in normal position. Should there be any question as to the adequacy of fixation, one

should not hesitate to drill another hole in the malar bone just below the zygomatic-frontal suture line and, with a small loop of wire, fix the malar bone to the zygomatic process of the frontal bone (Fig. 5, B_2).

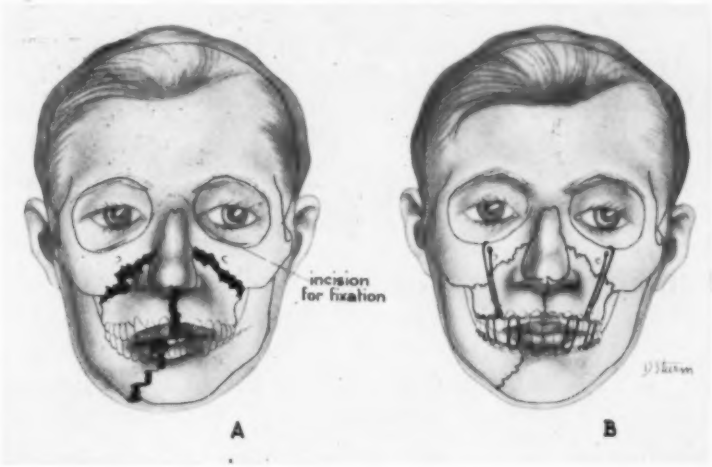


Fig. 3.—*A*, Complete bilateral fracture of maxilla with separation in midline; associated compound fracture of the mandible at the symphysis. *B*, Metal arch bands attached to upper and lower teeth, fractures of maxilla reduced and held in normal position with wires from infraorbital ridges to upper arch bands on both sides; upper and lower teeth fixed in occlusion with orthodontic rubber bands.

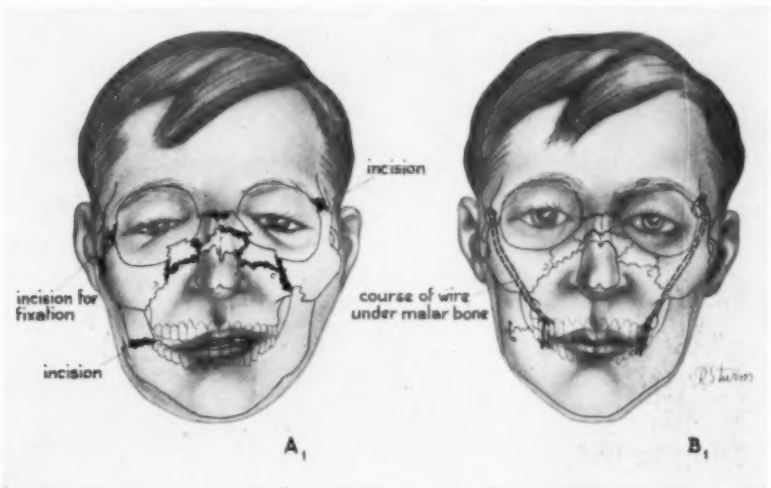


Fig. 4 (Case 1).—A_1, Complete bilateral fracture of maxilla, comminuted fracture of infraorbital ridges, and nasal wings, fracture of both malar bones; fracture of right mandible just above angle of jaw. B_1, Fracture of right malar bone reduced and wire passed from frontal bone behind body of malar bone and attached to upper teeth, fixing the maxilla and malar bones on this side. Same procedure repeated on left, and, in addition, malar wired separately to frontal bone because of gross displacement; fracture of right angle of mandible fixed by open reduction and wiring, upper and lower teeth wired in occlusion.

In these cases, the malar bone and zygomatic process may be elevated by several other methods. By such methods, however, the malar bone, if completely detached, may subsequently be displaced by the strong pull of the masseter muscle. With the procedure described, the bones may easily be restored to their normal positions and the malar bone firmly fixed to the frontal bone by wiring, through the one incision. Associated fracture of the zygomatic arch, after reduction, does not require fixation, since it has adequate support from the underlying temporal muscle.

Following reduction and immobilization of fractures of the maxilla and other facial bones, associated fractures of the nasal bones are reduced and maintained in position by a nasal splint, according to the routine method of treating such fractures when encountered alone.

In bilateral fractures of the facial bones, the foregoing procedures are carried out, as indicated, on both sides. In bilateral horizontal fractures of the maxilla with separation in the midline (Fig. 3), the two halves are drawn together and immobilized with arch bands or wires. This should precede open reduction and fixation of the maxilla to the upper unfractured bones. If the mandible is not fractured, fixation of the upper to the lower jaw is unnecessary.

Oral Hygiene.—This is of the utmost importance. The mouth should be thoroughly irrigated every hour until the infectious stage has passed, and thereafter three or four times daily. Normal saline, boric acid, or any mild antiseptic solution may be used for the irrigations, though ordinary tap water suffices. Sterile solutions are neither practicable nor necessary. Unless quite sick, the patient may himself carry out the procedure. The equipment consists merely of a large douche can or intravenous flask and three feet of rubber tubing to which a hard rubber or metal irrigating tip is attached. The can is placed at least two feet above the patient's head, so that the force of the stream may be ample to insure adequate cleansing. In addition to this measure, the patient should be encouraged to brush his teeth with a small brush when possible.

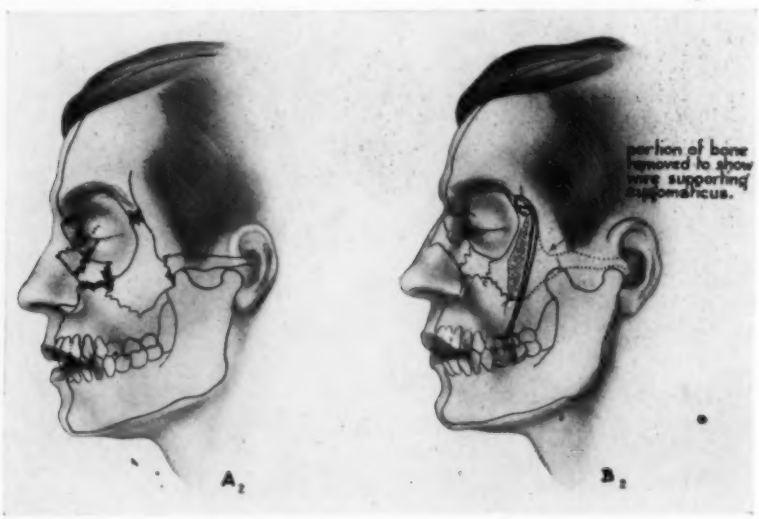


Fig. 3 (Case 1).—A_2, Lateral view, left side, showing fractures of the facial bones; B_2, Lateral view, showing course of wire from the frontal bone to the upper teeth, supporting the malar bone in normal outward and upward position.

The wires are allowed to remain in place for three to nine weeks, depending upon the location and type of the fracture. One may feel free to leave them undisturbed as long as necessary, since they cause little or no discomfort, as in the case when an extraoral appliance is used.

After healing is complete, the wire is severed through a small spearpoint incision over the loop and removed through the mouth, in order to avoid contamination of the soft tissues above.

Nature is kind in the treatment of these facial injuries, in that the blood supply of the tissues is abundant and healing takes place quickly. The scar

over the infraorbital ridge, being horizontal, is almost invisible, while that over the supraorbital ridge is at the edge of the eyebrow and consequently is also inconspicuous.

In only one case treated by the above method has infection developed. This was a bilateral fracture of the maxilla with fractures of both zygomas and of the nasal bones. Paradoxically, it was the first case in which we ever used sulfanilamide locally. The drug was placed in the wound on only one side, and this was the wound which became infected. The wires were not disturbed, as the infection subsided following incision and drainage and treatment with hot compresses. There was no infection in the wound of the opposite side wherein sulfanilamide was not used.

The following cases illustrate the application of this procedure in the various types of fractures of the facial bones.

Case 1.—W. W., a white male, aged 52 years, was lying on the floor, working on the rear axle of a car from which the wheels had been removed, when the jacks slipped and the axle fell across his face. He was admitted to the hospital four hours later, suffering acutely and in a state of mild shock. Pantopon was given and the routine treatment for shock, including glucose intravenously, was carried out.

On inspection, all the soft tissues of the face were grossly swollen, the eyelids being almost completely closed from the edema. The middle third of the face was elongated from displacement of the maxilla inferiorly and posteriorly, the orbital rim was elongated vertically from a downward displacement of the infraorbital ridges, there was a comminuted fracture of the nasal bones, and the malar bones were depressed. On palpation, it was apparent that all the facial bones were crushed. In addition, there was a fracture of the mandible just above the angle on the right, with anterior and lateral displacement of the posterior fragment.

Almost immediately following the emergency treatment, the patient had a severe rigor, followed by a temperature of 104° F., and it was felt unwise to manipulate the fractures at this time. His fever subsided under treatment with sulfanilamide and two days later reduction and immobilization were carried out under local anesthesia.

The left malar bone was widely displaced, necessitating separate wiring to the zygomatic process of the adjacent frontal bone. Small holes were then drilled in the frontal bone lateral to the orbital region just above the zygomatic-frontal suture line on both sides, a No. 25 stainless steel wire was threaded through the opening, and the two ends of the wire were carried downward behind the malar bone and under the soft structures of the cheek, into the upper sulcus of the mouth in the region of the first and second molars. After elevation of the zygomatic arches and malar bone, the soft tissue wounds were closed. Eyelet wires were next placed around the upper and lower molar teeth on both sides. The maxilla was then restored to its normal position and the wires from above were drawn taut and tied to those about the teeth of the lower jaw. In this manner the teeth were held in occlusion and, at the same time, the fractured bones were maintained in proper position. The anterior wall of the antrum was elevated with a male urethral sound inserted through

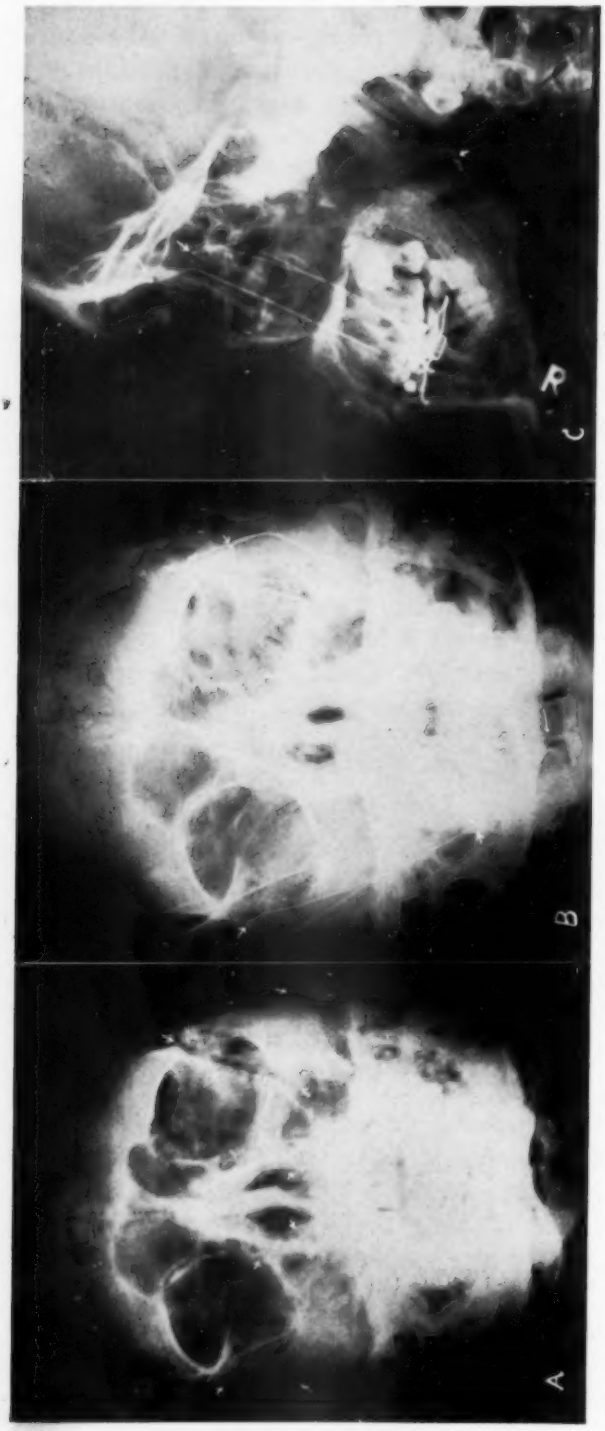


Fig. 6 (Case 1).—*A*, Preoperative roentgenogram, arrows designating fractures; *B* and *C*, roentgenograms after open reduction and fixation, points of wiring designated by arrows.



Fig. 7 (Case 1).—*A*, Preoperative photograph two days after injury; the displacement of the facial bones is obscured by the swelling of the overlying soft structures. Due to the downward displacement of the maxilla, the patient was unable to bring teeth of the lower jaw in occlusion with the upper jaw. *B*, and *C*, Two months postoperative, showing teeth in occlusion and normal facial contour.

the nares, the nasal bones were replaced, the passages packed with vaseline gauze, and an external nasal splint was applied.

Postoperative roentgenograms revealed the maxilla and other facial bones in good position. The displacement at the right angle of the mandible, however, was still apparent. Since it was impossible to reduce and maintain this fracture in normal position by manipulation, an incision 2 cm. long was made over the angle and the bones were apposed and fixed with a No. 25 stainless steel wire.

During the first week, oral irrigations were carried out hourly, supplemented by the use of oral pentacresol at frequent intervals. The patient had a slight temperature for several days, though this gradually subsided under treatment with sulfanilamide. He improved rapidly thereafter and was able to leave the hospital two weeks following his admission. The wires around the facial bones were removed in the office eight weeks postoperatively. Because of the fracture of the mandible, it was necessary to maintain fixation of the lower to the upper jaw for a longer period. The patient now has full motion in the lower jaw, both vertically and laterally, the teeth are in good occlusion, and the contour of the face is normal.

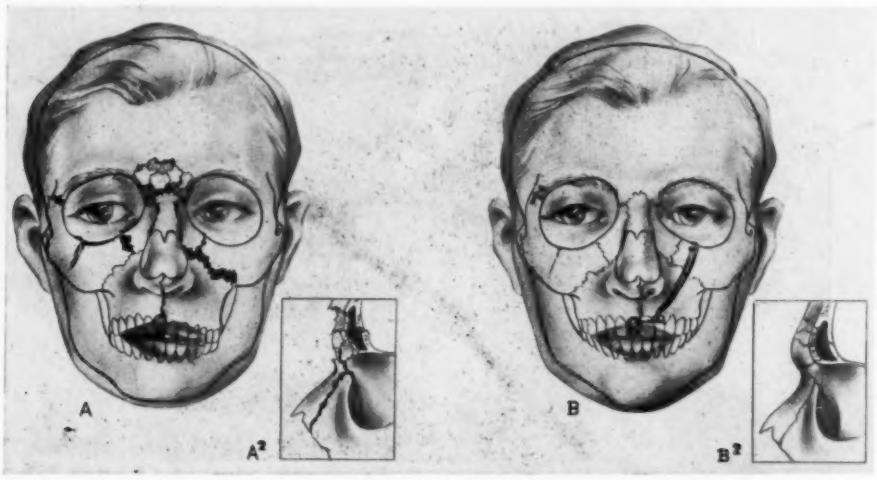


Fig. 8 (Case 2).—*A*, Bilateral fracture of the maxilla, greenstick fracture of the right half, without displacement; complete bony detachment of the left half of the maxilla with downward displacement of the right malar bone, crushing fracture of the nasal bones and infraorbital ridges, depressed fracture of the anterior and posterior walls of the frontal sinus, fracture of the cribriform plate.

B, After reduction of fractures, the points of wiring fixation at the right zygomaticofrontal suture line and the left infraorbital ridge.

A_2, Lateral view showing fractures of the frontal sinus region. B_2, postoperative lateral view.

Case 2.—H. A. was a white male, aged 33 years. He was a passenger on the front seat of a car which was driven into a telephone pole, causing the midportion of his face to strike the instrument board. He was admitted to the hospital an hour later and immediately given routine treatment for shock.

There was a laceration two inches long through the periosteum of the forehead; multiple lacerations about the right eye; a deep stab wound over the upper part of the nose and frontal sinus region, extending into the frontal sinus and nasal cavity; lacerations of the right ala; and an irregular through-and-through laceration of the upper lip. The middle part of the face was depressed and elongated. The right upper central and lateral incisors had been knocked out, and the remaining upper, as well as the lower central incisors were loose.

Examination revealed a compound crushing fracture of the nasal bones extending into the frontal sinus; the anterior wall of the frontal sinus was depressed and in contact with the posterior wall, and there was an opening in the posterior plate through which a small amount of brain tissue protruded. All the bony structures of this region were movable, including the cribriform plate. In addition, the infraorbital regions were crushed inward, there was a greenstick fracture of the right maxilla without displacement, a fracture of the left half with gross downward and backward displacement, complete detachment of the right malar bone, and a depressed fracture of the zygomatic arch.

The skin about the wounds was thoroughly cleansed, local anesthetic given, and the wounds copiously irrigated with warm saline solution. Through one of the soft tissue wounds at the outer margin of the supraorbital ridge on the right, the fracture in the frontozygomatic region was exposed and with a heavy metal elevator and external manipulation, the malar bone and zygomatic arch were restored to normal position. The malar bone was anchored to the zygomatic process of the frontal bone with small stainless steel wire and the incision was closed.

Before manipulation of the fractures about the nose and maxilla, the nasal mucosa was cocainized and the maxillary region was anesthetized with nerve block and deep infiltration of novocain. Through a small incision over the left infraorbital ridge, a hole was then drilled in the unfractured portion of the left malar bone and a loop of wire threaded through the opening and passed down beneath the soft tissues of the cheek along the anterior wall of the antrum, into the upper sulcus. The fracture of the maxilla was next reduced, the occlusion of the teeth tested by bringing the lower jaw into contact with the upper and the wire tied around the upper teeth on the left side, holding the maxilla up in proper position.

Because of the fracture of the cribriform plate, extreme care was exercised in reducing the fractures about the nose and frontal sinus region. The anterior wall of the frontal sinus was elevated and the sinus again copiously flushed with normal saline solution. Since there was a large fracture opening from the frontal sinus to the nasal cavity, the overlying soft tissue wound was closed without external drainage.

After replacing the bony cartilaginous nasal septum in the midline, a small stainless steel wire was threaded through and through the nose over a lead plate on each side. With a trocar antral windows were then made under the inferior turbinates. In order to allow free drainage, packing of the nasal passages was omitted. The patient left the operating room in fairly good condition, though the prognosis was regarded as poor.

An examination by a neurosurgeon revealed nothing of particular significance except the presence of blood from the middle ear in the external auditory canal on the left. Only conservative treatment was therefore advised.

The patient was given 15 gr. of sulfanilamide every four hours and fluids were limited. His temperature reached its highest of 102⅕° F. on the first postoperative day, and thereafter gradually subsided, reaching normal on the fifth day. The nasal splints were removed at the end of the week and he left the hospital three days later. His subsequent course was smooth, his only

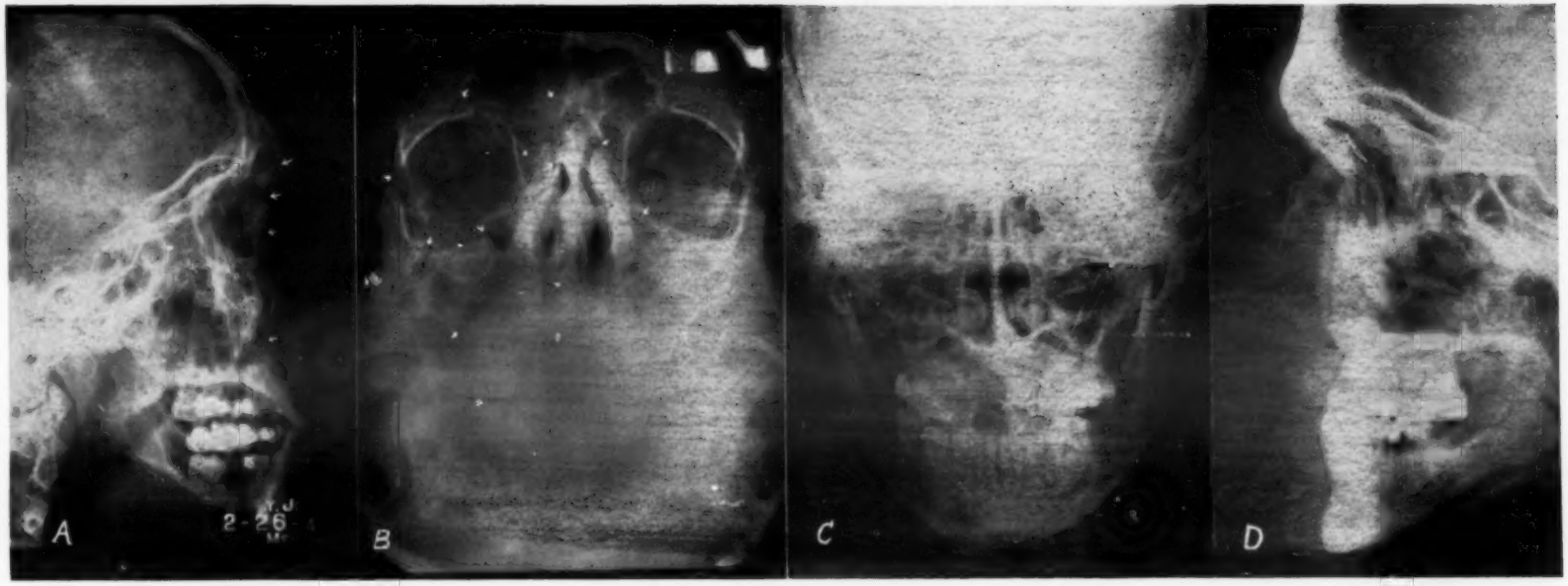


Fig. 9 (Case 2).—*A* and *B*, Preoperative roentgenograms; arrows designate fractures. *C*, Immediate postoperative roentgenogram showing facial bones after wiring fixation. *D*, Postoperative roentgenogram one year later; the wire at the right frontozygomatic suture line still in place, facial bones in satisfactory position.



Fig. 10 (Case 2).—*A*, Photograph immediately after injury showing multiple lacerations and distortion of facial features; downward displacement of the right eye. *B* and *C*, Postoperative photograph one year later showing perfect occlusion of the teeth with satisfactory restoration of normal facial contour.

complaints being a double vision and vertigo. The fixation wire of the maxilla was removed in the office nine weeks after insertion.

It has now been two years since the injury and the patient has been working regularly for the past year and one-half. His facial contour is normal, occlusion of the teeth is perfect, the nasal passages are unobstructed, his hearing is not appreciably impaired, and he no longer has double vision. On turning his head quickly from side to side, he has a transient vertigo as a result of the injury to the left semicircular canal, but otherwise has no noticeable difficulty from the injury.

CASE 3.—T. S., a colored male, had been struck in the face by a train one hour before his admission to the hospital. In addition to multiple small lacerations about the face, he had a complete laceration of the upper lip in the midline, and a traumatic cleft extending through the alveolar ridge, the hard palate, and the nasal cavity, into the left antrum. The lower lip and tissues over the mandible were also completely lacerated in the midline and the symphysis was widely separated. The two upper central incisors and the left lateral incisor were loose, and the lower central incisors had been knocked out. There was also a fracture of the zygomatic process on the right.



Fig. 11 (Case 3).—*A*, Bilateral fracture of maxilla, greenstick fracture of right half and complete detachment of left half, with separation in the midline; fracture of both infraorbital ridges, dislocation of right malar bone, and compound fracture of the mandible at the symphysis.

B, Arch bands wired to upper and lower teeth, left half of maxilla immobilized in proper position with wires extending from body of malar bone to left upper teeth; fracture parts of infraorbital ridges wired together and right malar bone held in position by wire through frontal bone. Fixation of greenstick fracture of right maxilla was unnecessary; upper and lower teeth were maintained in occlusion with orthodontic rubber bands.

Roentgenograms demonstrated a greenstick fracture of the right maxilla without gross displacement, complete displacement of the right malar bone downward and inward with a fracture of the right zygomatic arch, a complete fracture of the left maxilla with the bone attached only to the soft tissues, detachment of the nasal bones from the frontal process with displacement to the right and downward, a crushing fracture of both infraorbital ridges downward, a midline fracture of the alveolar process extending into the hard palate with separation of the two halves, and a fracture of the mandible through the symphysis with wide separation.

The soft tissue wounds were repaired immediately after the patient's admission to the hospital, but because of his poor condition, no attempt was made

to treat the bony injuries. He ran a low-grade temperature for a few days, during which time sulfathiazole was administered. As soon as his general and local condition permitted, arch bands were placed around the upper and lower teeth to bring together the midline fractures of the maxilla and mandible. The bones were then restored to their normal positions and the fractures of the infraorbital ridges were immobilized by separate wiring of the fractured parts to the malar bone on both sides. To maintain reduction of the left maxilla, a wire was looped through the maxillary process of the malar bone and the ends brought down and attached to the arch band about the teeth. The right malar bone was wired to the frontal bone at the suture line. Although there was slight motion of the right half of the maxilla, being a greenstick fracture without displacement, wiring fixation was unnecessary. The teeth of the upper and lower jaws were brought into occlusion and held in place with rubber bands between the arch wires.

The arch bands and wire supporting the left half of the maxilla were removed six weeks later. The patient had no postoperative complications, and the roentgenograms showed all the fractured parts in good position.

Case 4.—A. L. T., a white male, aged 60 years, was in an automobile accident October 5, 1942. The patient was thrown forward, his face hitting the instrument board. He was seen in the hospital one hour later and found to be in severe shock with symptoms of concussion. The patient was given routine treatment for shock along with other supportive measures.

Local findings (Figs. 14*A* and 15*A*) revealed swelling of the entire face with ecchymosis and edema about both eyes, bleeding from both nares and the roof of the mouth. The patient was edentulous.

There was a complete bilateral horizontal fracture of the maxilla with gross displacement downward and backward, causing considerable difficulty in swallowing. There was a through-and-through laceration along the posterior border of the hard palate. (Fig. 14*B*.) All the nasal bones, as well as the nasal septum, were quite mobile. There were a greenstick fracture of the right zygoma, a fracture of the left zygoma, completely detached, with gross displacement downward and inward, and multiple fractures of the left infraorbital ridge with downward displacement. Both anterior antral walls were crushed inward.

The day following admission to the hospital, the patient was taken to the operating room. Under a combination local and general anesthesia, the fractures were reduced to their normal position and held in place by internal wiring fixation.

Under local anesthesia (novocain infiltration), a small incision was made at the outer margin of each eyebrow. A small hole was drilled in the zygomatic process of the frontal bone and a strand of No. 25 stainless steel wire was threaded through this hole. The double strand of wire was then threaded through the eye of a malleable dissecting probe, and carried downward behind the zygoma and under all the soft structures of the face, making its exit in the upper sulcus of the mouth (Fig. 16).

Patient was wearing his full upper and lower dentures at the time of the accident. Although a small portion of the upper denture was broken off in the accident, the plate was still usable. Small holes were drilled in the plate

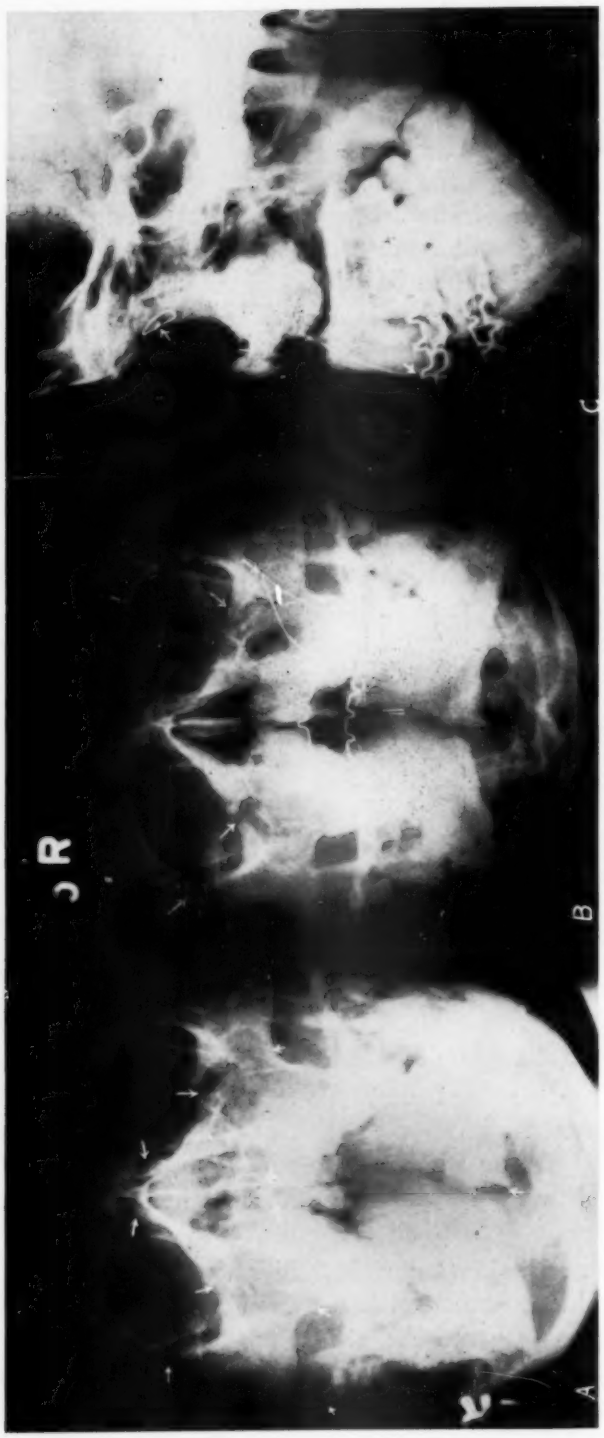


Fig. 12 (Case 3).—*A*, Arrows designate fractures, as illustrated in Fig. 11, *B* and *C*. Roentgenograms after open reduction and internal wiring; points of fixation designated by arrows.

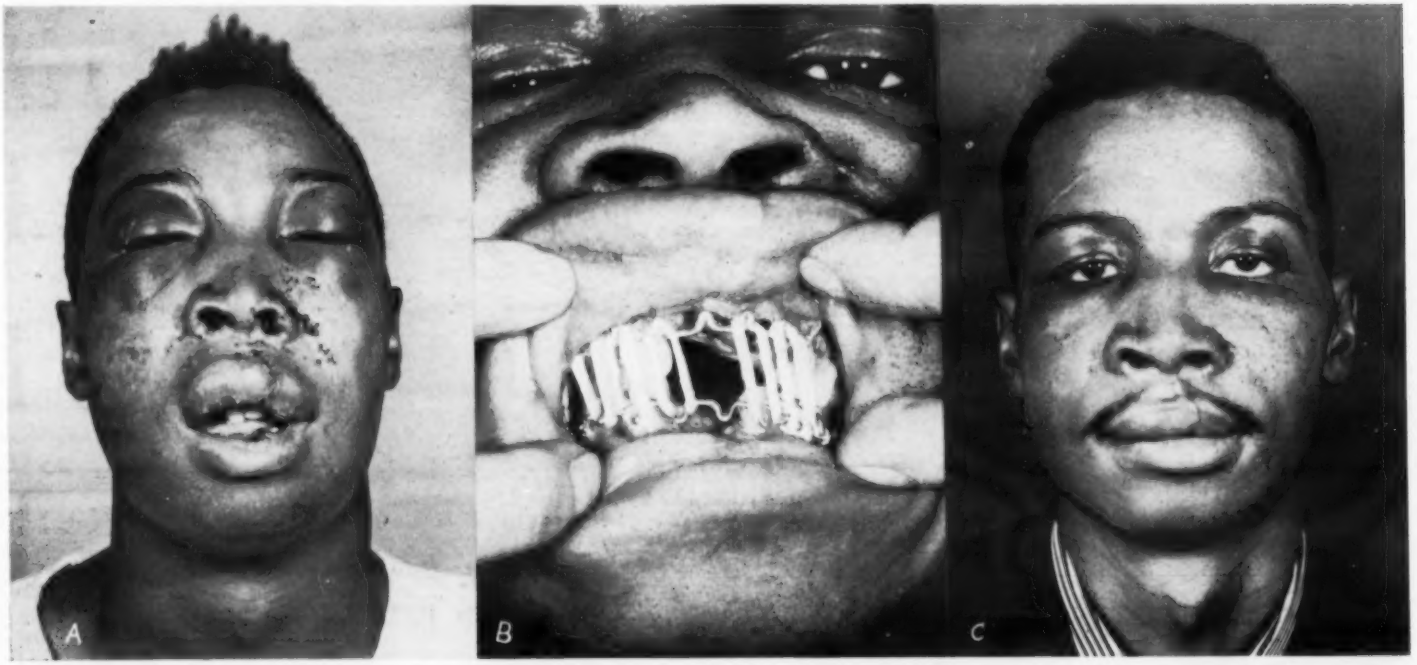


Fig. 13 (Case 3).—*A*, Preoperative picture one week after injury showing soft tissues still swollen, obscuring the deformity of the fracture and definite elongation of the middle one-third of the face; patient unable to bring teeth in occlusion.

B. Postoperative photograph showing arch bands around upper and lower teeth held together with orthodontic rubber bands.

C. Postoperative photograph two months later showing normal facial contour; scar of the upper lip may be improved by plastic repair.

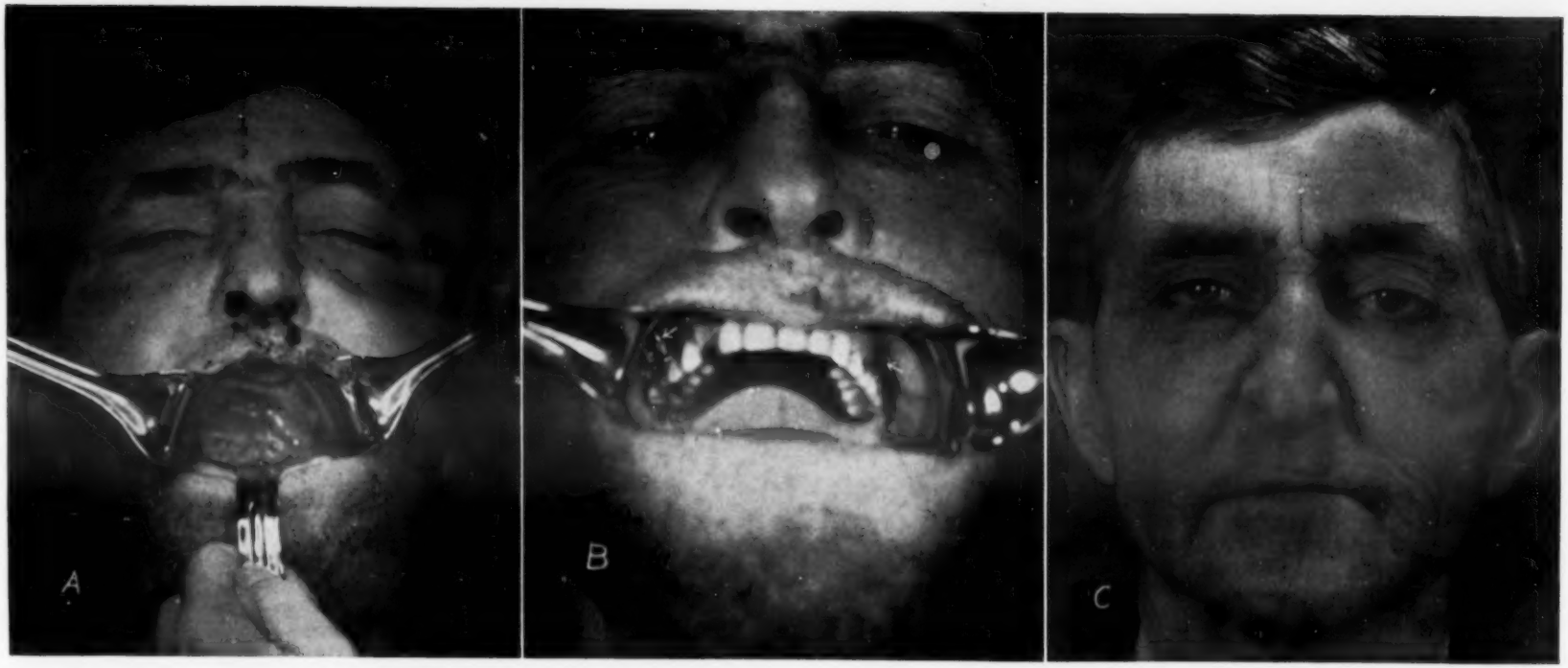


Fig. 14.—*A*, Preoperative photograph showing general swelling of the face, ecchymosis about the eyes and the bleeding of the nose. Downward displacement of the maxilla into the mouth producing a laceration of the roof of the mouth at the junction of the hard and soft palates. *B*, Postoperative photograph showing fixation of the maxilla, utilizing the patient's upper denture. Note: exit of wires in the upper sulcus of the mouth on both sides, running from the zygomatic processes of the frontal bone and tied to the plate in the region of the second molar. *C*, Patient three months postoperative.

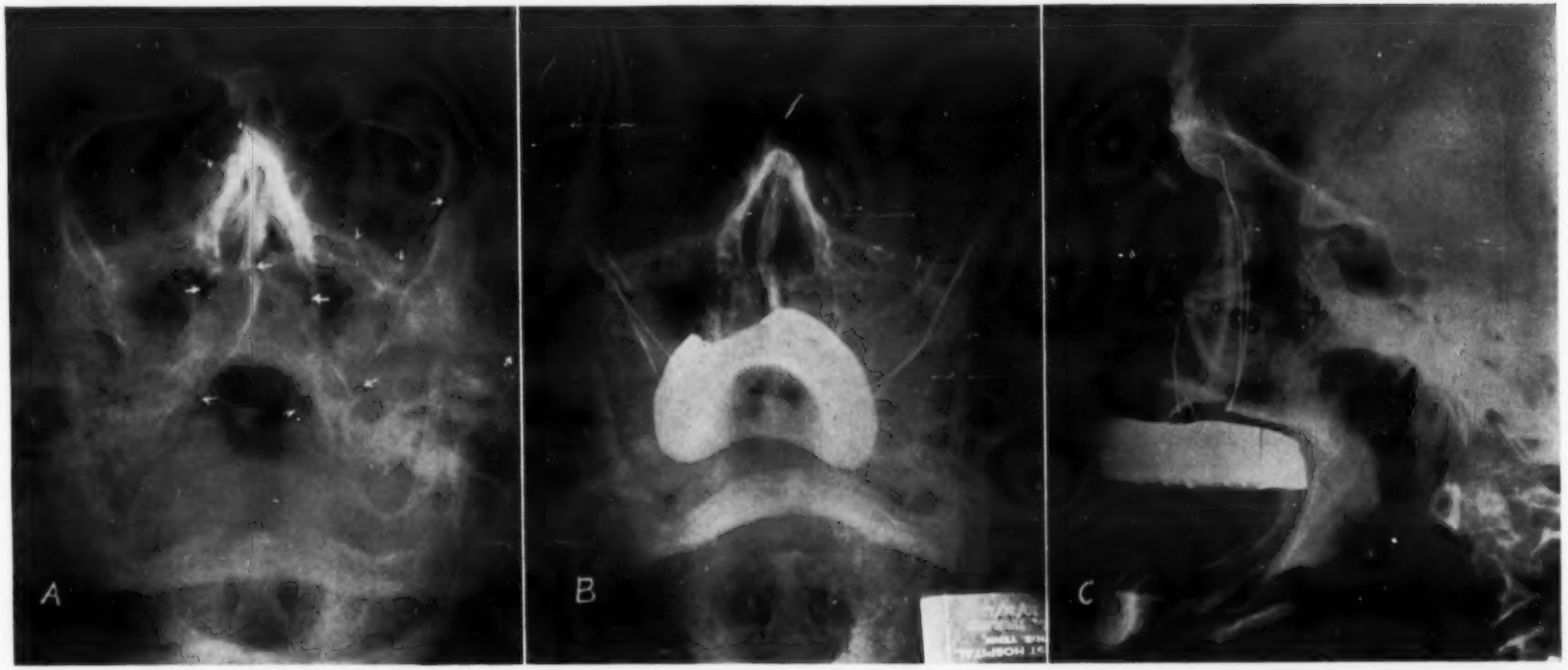


Fig. 15.—*A*, Roentgenogram showing complete horizontal fracture of the maxilla with displacement downward. Complete detachment of the malar from the frontal bone with fracture of the zygomatic arch. Multiple fractures of the left infraorbital ridge with gross displacement. Fracture of the nasal bones. *B* and *C*, After open reduction and internal wiring fixation, using full upper denture as a support for the maxilla. Note: wires running from the zygomatic process of the frontal bone down to the full denture.

on either side of both molars to receive the wires from the zygomatic processes of the frontal bone.

Before reducing the facial fractures, the patient was given sodium pentothal anesthesia. The left zygoma was first elevated to its normal position with a male urethral sound through the incision at the outer border of the eyebrow. The maxilla was then placed in its normal position and the internal wires from the frontal bone were tied to the full upper denture on either side (Figs. 14*B* and 15*B* and *C*). An incision was made along the left infraorbital ridge and the bony fractures of the infraorbital ridge were elevated to their normal position and held in place by separate wiring fixation, using a No. 26 stainless steel wire. Small openings were made in the nasal walls of both antra under the inferior turbinates, and with a male urethral sound the anterior antral walls were elevated. The nasal septum was placed in the midline, nasal bones were molded into normal position and held in place by an external nasal splint of tin. Both nares were gently packed with carbozine nasal packing.

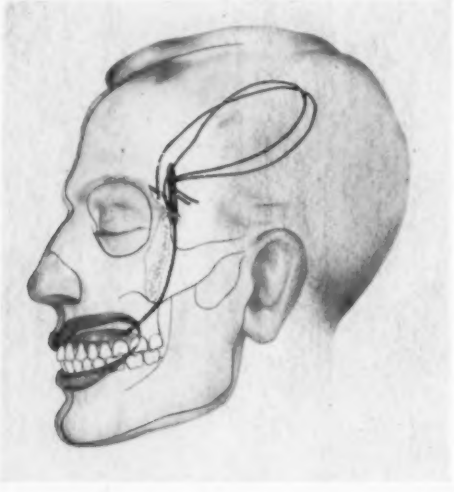


Fig. 16.—Illustrating the use of a standard malleable dissecting probe as a needle for carrying the double strand of No. 24 or No. 25 stainless steel wire, after having been threaded through the hole drilled in the zygomatic process of the frontal bone, down behind the zygoma and under all the soft structures of the face and making its exit in the upper sulcus of the mouth in the region of the second molar tooth.

Nasal packing was removed after 48 hours. Nasal splint was worn for one week. Sutures of the skin incisions were removed six days postoperatively. The patient was up walking about the hospital on the third postoperative day and was discharged at the end of two weeks.

The patient had an uneventful recovery. The wires holding up the maxilla were removed under local anesthesia, in the office eight weeks later (Fig. 14*C*).

SUMMARY

A simplified method of reduction and fixation of fractures of the maxilla and other facial bones has been described. For the approach, two small incisions are used at the outer or inferior orbital ridge, on one or two sides depending upon whether the involvement is unilateral or bilateral. The procedure requires a minimum amount of time and equipment, a small drill, pair of pliers, spool of small stainless steel wire, and a dissecting set.

902 Madison

Editorial

Dentistry and the War

Dentistry is giving a wonderful account of itself in the present emergency. Twelve thousand dentists are already in the Army, and it is expected that seven thousand more will be added this year. According to a statement by Brigadier General Mills, in one month of last year 461,988 fillings were placed in the Army dental clinics of the United States; in addition 633 fixed bridges were set, and 5,791 dentures constructed. Actual conflict, however, will bring new problems, and these will become more and more important. They are the problems of the oral and plastic surgeon; the repair of maxillofacial injuries and the rehabilitation of men with mutilated jaws and faces.

The civilian dentist also may be expected to participate in this type of work should the bombing be extended to our shores. Injuries caused by the bombing of cities bring forth many types of wounds of the face and fractures of the jaws not seen in ordinary times. Accidents may be caused from collisions, the falling of masonry from wrecked buildings, shattered glass, and fragments of all kinds which produce casualties of great variety. Both the military and the civilian dentist may be called upon to give first-aid treatment, arrest hemorrhage, treat shock, apply bandages, administer anesthetics, and act as an auxiliary medical officer.

That the dental profession is alert to these possibilities and opportunities is quite evident. Universities are offering postgraduate courses in maxillofacial surgery to Army officers; dental societies are arranging courses in the fundamentals of medicine and surgery, in "first-aid treatment," in "anesthesia," and "oral and traumatic surgery of the jaws."

The Medical Division of the Office of Civilian Defense in April issued a statement recommending that dentists qualify themselves in first aid in order that they may act as instructors and as members of emergency medical field units in casualty stations and first-aid posts in the event of air raids, in the administration of anesthesia, and in the care of injuries of the face and jaws.

We read in the *Journal of the American Medical Association** that "sixteen dentists in Flint, Michigan, are taking special training in Flint hospitals at the invitation of the Genesee County Medical Society to enable them to assist physicians by performing certain medical procedures and thus relieve the shortage of physicians created by the demands of military service. The training will qualify the dentists in obtaining blood for examinations, intravenous feeding, intramuscular injections, intravenous injections, and obtaining blood from donors for blood banks. Several of the number are already qualified in some of these fields and are assisting in clinics and with Selective Service examining boards."

"Colorado dentists are engaged in a similar program under the auspices of the Colorado State Dental Association and the Committee on Emergency

*J. A. M. A. **120**: 543, 1942.

Medical Service of the State Defense Council. The plan was initiated by the presidents of the State Dental Association and of the Denver Dental Association, in cooperation with the board of trustees of the Colorado State Medical Society. Facilities of the University of Colorado School of Medicine and the Colorado General Hospital have been made available for the instruction. A class of seventy dentists has finished a course of lectures on anesthesia, and small groups are now assigned to the hospital for practical training. It is planned that the dentists shall return to the hospital at intervals for review after their training is completed. Preliminary lectures on shock and treatment of open wounds have also been presented.

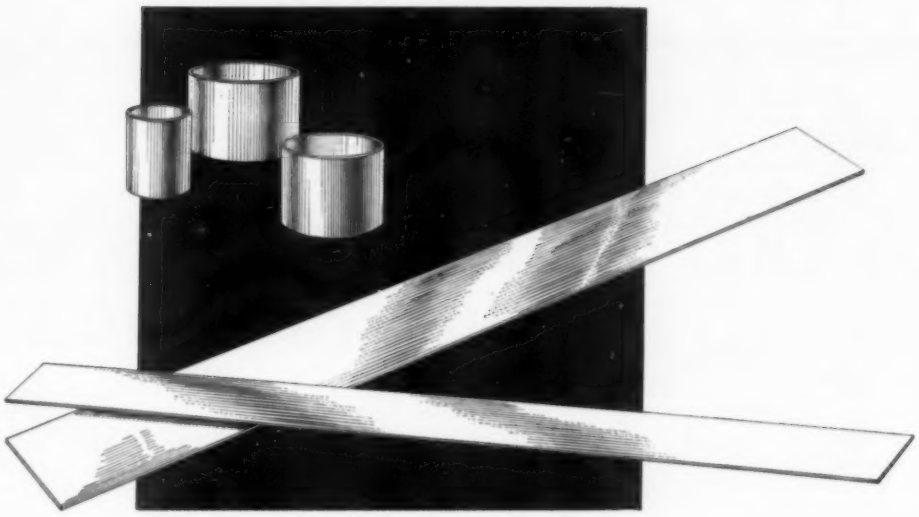
"Classes are being organized in maxillofacial surgery, oral surgery, serology, taking of blood for transfusion, and in the treatment of shock, hemorrhage and open wounds by many dental societies."

The Institute of War Medicine and Surgery for Dentists, sponsored by the Chicago Dental Society has been a great success. A postgraduate course was offered to members of the dental profession to help prepare themselves for the realities of war. A comprehensive program was planned and directed by Dr. Edmund J. Ryan. The meeting was held in the John B. Murphy Memorial Hall of the American College of Surgeons and consisted of lectures divided into four groups: 1. Topics of a background nature to aid dentists in understanding the larger issues involved in global war. 2. Topics of an essential military nature. 3. Topics of a basic medical nature. 4. Topics of a strictly dental nature. The last two groups of lectures included tropical medicine, traumatic surgery, military sanitation, military psychiatry, aviation medicine, nutrition, facial and jaw reconstruction, local and general anesthesia, and traumatic surgery of the jaws. The course was attended by 665 enthusiastic men from twenty-nine states who spent four full days, eight hours each day, to improve themselves.

The Massachusetts Dental Society has announced an educational course consisting of intensive lectures in "basic medicine and war surgery for dentists." The chairman, Dr. Harry B. Shuman, states in the announcement that the committee had in mind to offer the membership an opportunity to broaden their knowledge in fields which will make them more valuable in alleviating the pain and suffering of humanity should disaster come to us.

Thus the horizon of dentistry is constantly enlarging. While the specialty progresses, the base of education needs widening also, therefore the great interest in the fundamentals of medicine and surgery. All medical specialties derive their fundamental knowledge from the great reservoir of science, and dentistry, after all, is a specialty of medicine. The war is bringing it out; the enthusiasm with which lectures on medical subjects are received by the profession is the proof.

K. H. T.



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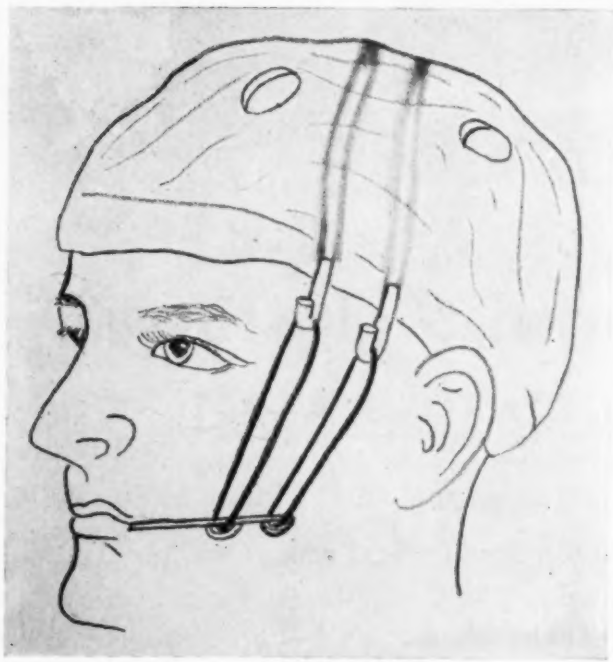
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American Journal of Orthodontics and Oral Surgery

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